ELECTRONICS Australia

September, 1967

Incorporating RADIO, TELEVISION & HOBBIES Vol. 29 No. 6

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Guitar loudspeakers • TAA communications

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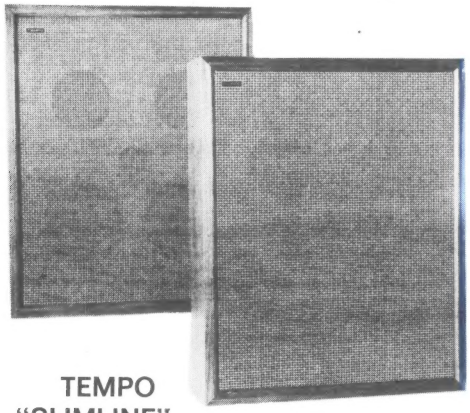

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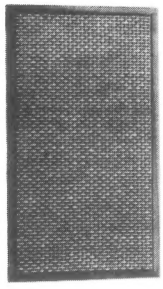
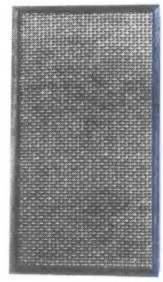
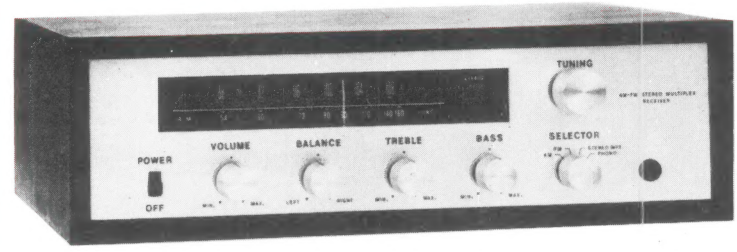


TEMPO BOOKSHELF SPEAKERS

are also available in two sizes: 'MINI', 14" x 8" x 8" and 'PEERLESS', 21" x 11" x 9".





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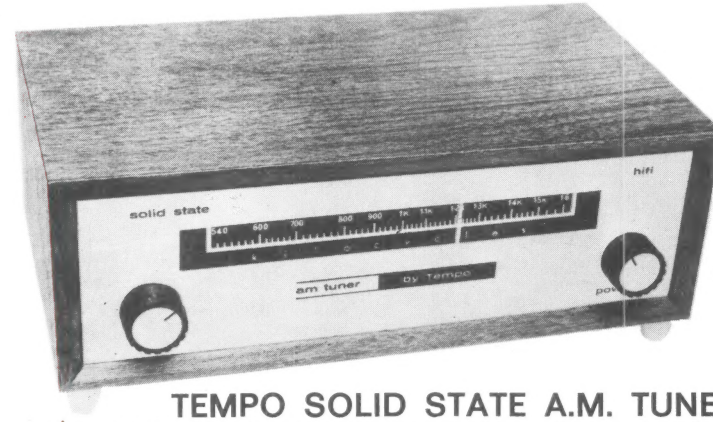

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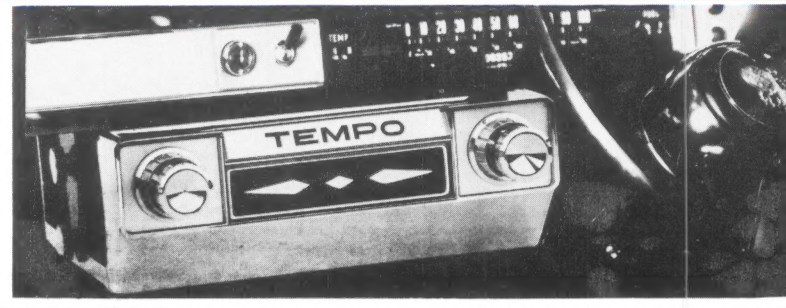

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The Serviceman

Some of the stories which have been related recently by "The Serviceman" don't make pleasant reading and some may well feel that they are stories which might better have been suppressed. For our part, there was a strong temptation to do exactly that and to avoid "rocking the boat."

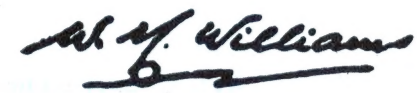
Service malpractice is not a new subject, of course, nor is it confined to the servicing of electronic equipment. One hears it raised, from time to time, in connection with most repairable consumer products. If it seems more urgent in connection with radio and television receivers, it is probably because the average man in the street is less able to evaluate the relevant faults and corrective measures than he is in the case of his motor car or his hot water service.

Much has been said in the past about radio and television servicemen who are inexperienced, or who have little real knowledge of the equipment which they are trying to repair. However, while we would not seek to condone ineptitude there is the saving feature that, with application and experience, even the rawest "valve jockey" can ultimately become a proficient serviceman.

The lamentable aspect of the recent stories is that they carry the stamp, not of ineptitude, but of calculated fraud. Here are professional servicemen, not content with earning a normal living, but bent on "taking down" anyone they possibly can. For such men the main effect of further experience will be to enable them better to pick the "suckers" and to render them even less sensitive to possible pangs of conscience.

What defence has the public against such operators?

I suggest applying the same technique as one normally uses in other fields: Don't put urgency ahead of discretion and don't call in a serviceman because he happens to have the biggest advert in the local paper. Seek a recommendation. Check with the manufacturer or distributor of the brand or with a local retailer with whom you may have a contact. Ask your friends and neighbours about any radio or TV service they have had in recent months. Better three or four days without television than 30 or 40 dollars down the drain!



September, 1967

COVER PICTURE: A TAA ground engineer talks with the captain of a Boeing 727 during preparation for take-off. The engineer must give the all-clear to start the engines and may help to guide the plane to the clear taxiway. Once the umbilical cord is disconnected, the pilot relies on radio for the remainder of the journey. *(See story, page 8.)*

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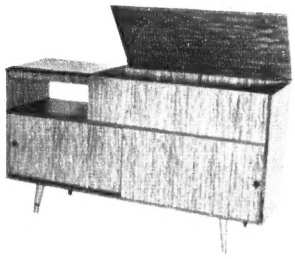
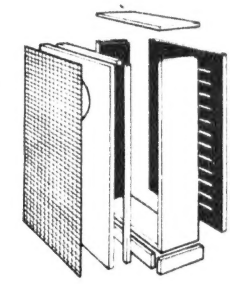
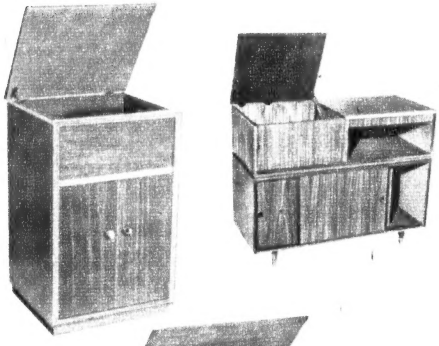


make your own cabinets and save $ $ $





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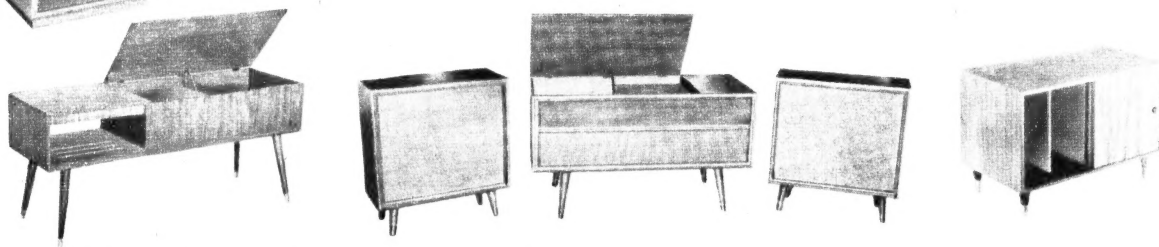

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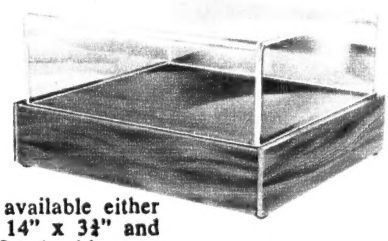
Rigidly constructed using only best quality veneered panels in oiled Teak, Queensland Maple and Walnut, these Instrol Player/Changer Stands are widely accepted throughout the Hi-Fi Trade for most makes and models of players and changers. Size of player's top is 15¼" wide by 14¼", and the inside depth is 3". A neatly set-in protective base with rubber feet is included. For a small extra charge, we can supply the base ready cut for your player or changer.



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Extra for cutting to template **$0.75**

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PLEASE NOTE: Our Hi-Fi Store is at Glebe, and the Phone is 68-1171. This does not yet appear in the telephone directory. The spare parts, test equipment, kit sales, etc., are still at the original address, 206 Broadway — Phone 211-4224 (3 lines). **Only the Glebe Store** is open on Saturday mornings.

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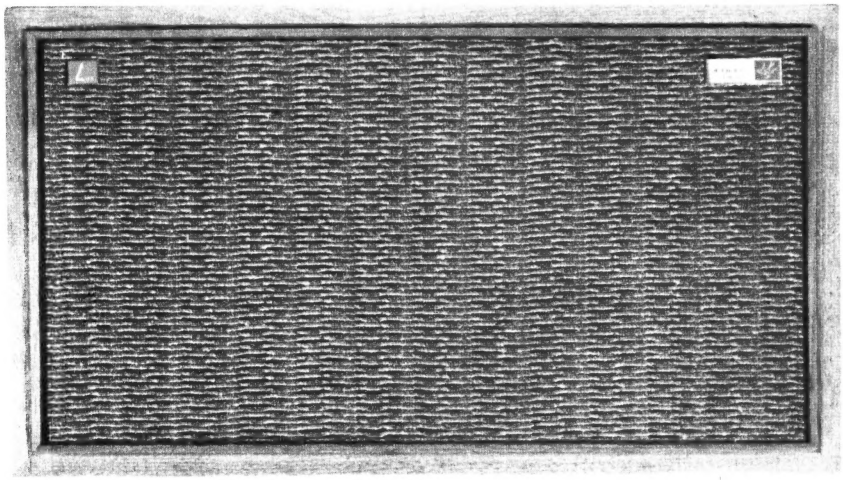

FISHER XP-7 SPEAKER

The new Fisher XP-7 at $198 is ranked among the very finest bookshelf speaker systems by all the experts who have heard it and tested it. It offers the kind of performance that critical audiophiles demand of loudspeakers costing twice as much—and more. The highs are remarkably smooth, widely dispersed and peak-free, thanks to the unique Fisher soft-dome tweeter. Two specially designed 5-inch cone drivers carry more than three octaves of the mid-range, resulting in a much more natural sound than is possible with a narrow-band approach to mid-range design. The heavy 12-inch woofer goes all the way down to 30 cps without doubling.

Complete range of FISHER amplifiers from **$240.00**
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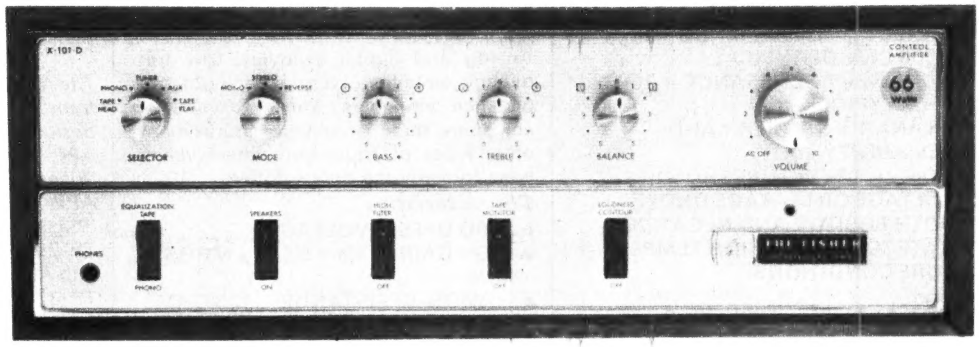

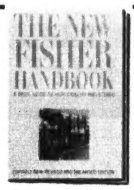

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in HI-FI ?

New!

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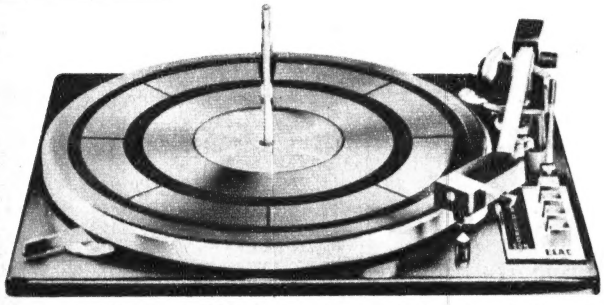
- **Frequency Response—Amplifier:** Within 1 db—35 cycles to 15 kc. Within 3 db—24 cycles to 20 kc.
- **Hum and Noise (below rated output):** —60 db.
- **Amplifier Sensitivity:** 0.55 volts RMS for full output.
- **Treble Control:** ± 15 db boost.
- **Bass Control:** ± 15 db boost.
- **Amplifier Type:** Fully solid state 14 transistors, 14 diodes.
- **Output Stage:** Quasi complementary pairs.
- **Power:** 230/250 Volt AC, 50 Cycles.
- **Power Consumption:** 40 watts.
- **Speaker System:** 2 separate oiled walnut cabinets, each with low frequency speaker mechanism and tweeter.
- **Turntable:** Four-speed, automatic and manual change, automatic cut-off and automatic repeat.
- **Size:** Unit—15" x 14" x 8". Speakers—14" x 8" x 8" each.
- **Weight:** Unit—18 lbs. Speakers—8 lb. each.
- **Finish:** Unit—Black matt finish with oiled walnut sides and smoke-grey perspex cover. Speakers—Oiled walnut.

RCA's new 'Stereo 10' has been completely designed in Australia for Australian Hi-Fi music lovers by craftsmen engineers experienced in professional equipment for Stereo and Mono reproduction. From the sound of a single note through to a full crescendo, this unit is virtually distortion-free, producing a magnificent, full-bodied tone through twin amplifiers.
The fully matched and integrated system provides the finest musical achievements with **big** sound reproduction from unobtrusive units. Each of the two bookshelf speakers has its own tweeter and powerful main speaker and will stand vertically or horizontally (even the famous RCA symbol is adjustable to suit either position). $292.

ELAC MIRACORD 50H



The Elac Miracord 50H has a transcription turntable of the luxury class with versatile operating facilities, tracking control, anti-skating device and automatic changer mechanism. Price complete, $148.

The finest automatic Turntable ever produced

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- Universally balanced, high-precision tone arm with tracking control and anti-skating device for even tracking of record groove flanks.
- No records project over edge of massive 12" turntable of non-magnetic zinc casting.
- Record speed setting indicated in illuminated window with push-button control for luxury operating convenience.
- Special feature — the cueing device, an important aid which no record lover should be without.

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COMMUNICATIONS — the nerve

While the public image of an airline is one of gleaming, high-speed jets and uniformed aircrew, its operations would very rapidly come to a halt without a matching jet-age system of communications. Backing its passenger and freight services, Trans-Australia Airlines have built up a huge, nation-wide communications network, quite additional to normal in-flight communication and navigation.

by J. R. E. Fullerton, DFC, DFM, C.Eng., AFRAeS, AMIERE.

(Ground Communications Controller, T.A.A.)

The facilities that TAA has established over the years add up to one of the most comprehensive private communications systems in the world; it is responsible for everything from handling of a local reservation telephone call to vital aircraft movement messages. In this description of the range of equipments used, and the large size of the network, we have not included those airborne communications and electronic systems operated in compliance with DCA regulations for communications and navigation. These vital equipments come under quite a separate section of the airline and would form a most interesting story in themselves.

In establishing communication systems for an Australian domestic airline, a major problem must be overcome that is not faced by international carriers. Overseas airlines have an advantage (in the communications sense) of long hauls between setdowns and therefore time for standard communications systems to process messages. On the other hand, with ever decreasing flight times on internal routes, brought about by Boeing 727 and Douglas DC9 jets, there is no latitude whatsoever for delay of the messages.

The demands of greatly increasing business and traffic dictate the pattern for the communications facilities that TAA has developed. And whether it be an extra extension for the switchboard or choosing a message switching system, it is all the responsibility of the Ground Communications Department.

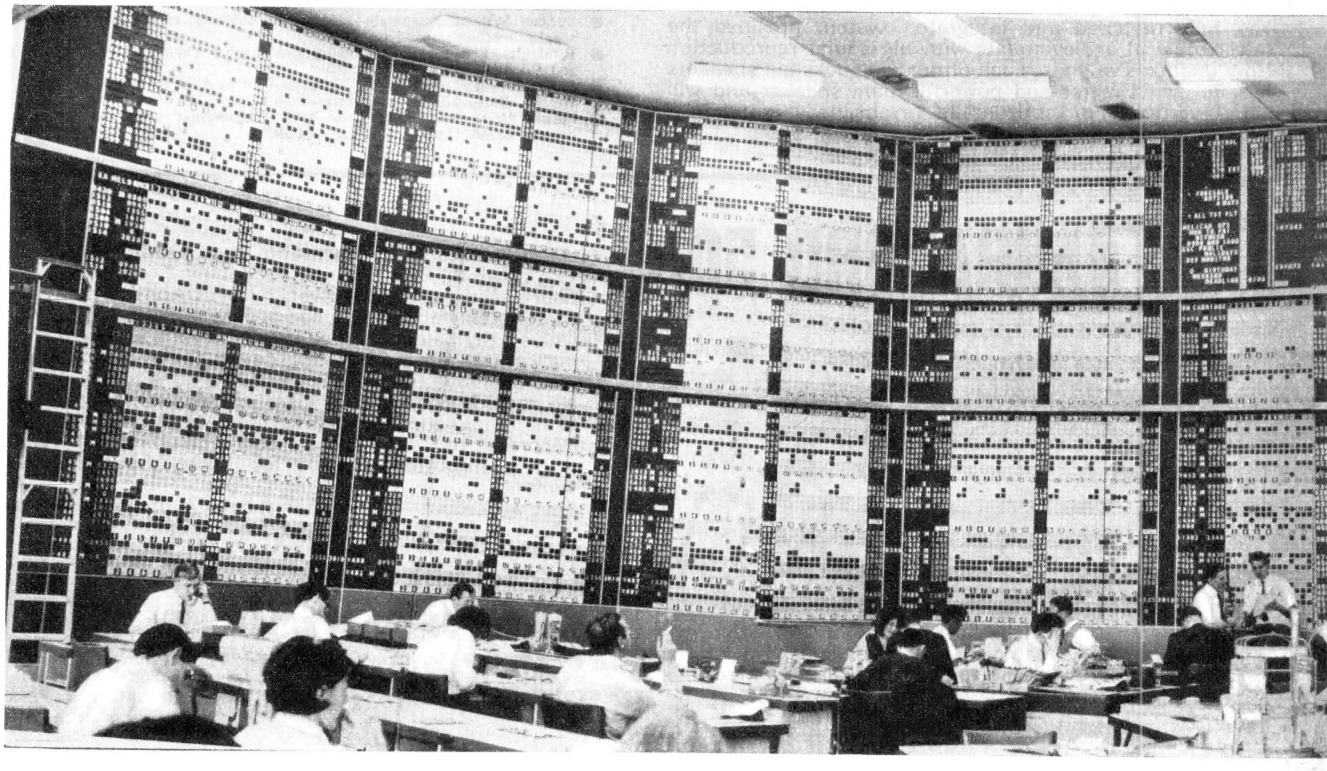
Not including written correspondence (letters, memos, etc.) the airline's ground communications can be broadly divided in five categories. They are: (1) Communications necessary for the vital interport and ground-to-air communications of the operations department; (2) Those for making reservations and allocating seats to passengers; (3) Those associated with cargo transhipment; (4) Those associated with aircraft maintenance, and (5) General airline administration.

The equipment used in these various services can be divided into three classes: Telephonic, telegraphic and electronic.

The large bulk of all this traffic is transmitted via TAA's own leased telegraph system, which is now the fastest and most extensive private automatic system in the southern hemisphere, handling approximately 3,000,000 messages a year, and almost 1,000 in the daily "busy hour." Additionally, where it is uneconomical to lease long lines, the more remote offices such as Darwin, Perth, Mt. Isa, Charleville, are equipped as Telex subscribers on the APO public telegraph system.

The system was introduced because of the inability of the earlier "torn tape" system, with its requirement for extensive manual handling at message relay stations, to provide adequate message transit times between offices, compatible with the fast flight times produced by modern aircraft; this, adding to ever-increasing traffic volume! Consequently, the Australian Post Office were contracted to provide an automatic electro-mechanical tape telegraph system. This was to provide efficient signalling during a period over which the "state of the art" of computer message switching proceeded to a level, both economically and technically, suitable to TAA's requirements.

Basically, the TAA telegraph system, in sending a message from office to office, works as follows: The Central Message Switching Centre is situated at



system of a modern airline

Sydney Airport, a location dictated by the economics of the long-line leasing costs associated with such an extensive network. To this centre, the TAA teleprinter equipped offices ("outstations") are connected for "duplex" (i.e. simultaneous both-way) working and the centre receives directly, via incoming lines, messages transmitted from any of the 42 outstations constituting the network. The incoming message at the Message Switching Centre is received on a tape reperforator terminating that particular incoming line.

As the first characters, including the line and transmission identity, priority indicators, and destination address, are received, the Message Switching Centre equipment "reads" the information and automatically switches the message across the office to the transmitting machine located on the outgoing line to the destination address, for onward transmission. The message is then typed out at the receiving office almost simultaneously with its transmission, even if it emanated from, say, Melbourne addressed to Townsville.

Should the particular line from the Message Switching Centre to the receiving station be engaged, the message is stored until the line becomes free and is then transmitted as usual. "Priority" messages automatically seize the required outgoing line ahead of routine messages.

Multi-address messages are treated in much the same way. The addresses are "read" on arrival at the switching centre and, instead of the one outgoing line, all the required outgoing lines are seized and the message is transmitted to all addresses simultaneously. Should one of the outgoing lines be engaged the entire transmission is held up until it is free. Whilst this may appear to be a disadvantage of the system, as messages for all ports except the one engaged are also delayed until the busy line is free, it must be pointed out that the average message delay at the centre is only a matter of a minute or so.

System fail and condition indicators are provided to alert the switching centre staff to abnormal equipment or traffic conditions. Mutilated messages or those with incorrect format are ejected from the switching sequence, and appear at a semi-automatic operator's console for investigation.

To understand more fully how the system operates, it is appropriate to take a look at the types of equipment employed. Before the Switching Centre was opened, it was accurately estimated that, whatever the equipment chosen, it would need to be able to handle much more traffic than the 9,000 messages estimated as the overall daily average by the end of 1966.

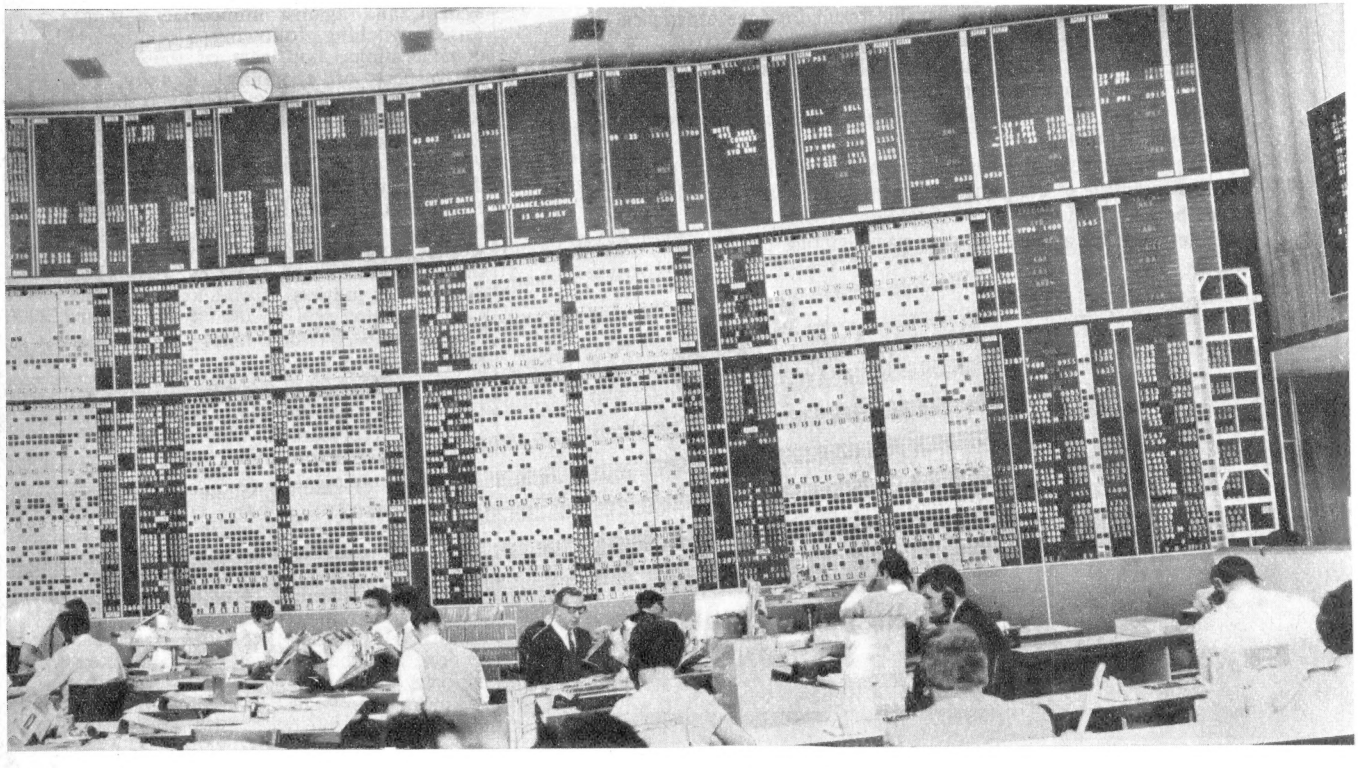
Standard telegraph transmitting machines are installed in all offices connected to the centre. For those who are not familiar with this method of communication, the machine, called a teleprinter, has a keyboard not unlike that of a typewriter, together with a small number of special buttons and switches to enable it to produce special functions. Additionally, another machine is provided in each office which performs the receive function of the office equipment and produces a printed page copy of incoming messages.

Messages are typed into the unit, which transforms each letter, number, sign and blank space into distinctive electrical impulses. These impulses are transmitted via P.M.G. lines and circuits at speeds of up to 100 words a minute. In fact, TAA was one of the first organisations in Australia to take advantage of improved P.M.G. facilities enabling this high speed; previous equipment was restricted to 66 words a minute.

As previously mentioned, the outstation transmission line feeds directly into an incoming telegraph "reperforating" machine at the Message Switching Centre. This unit is a version of a teleprinter, but without a keyboard. Also, instead of converting the electrical impulses back into words typed on to paper, it records them on a punched (perforated) tape. This is a ½-inch wide roll of paper tape, and each letter is transformed into a code, as a pattern of holes laterally across the tape.

As the message enters the centre a complex of electro-mechanical devices

Reservations for flights throughout the TAA network are accepted in this reservation control room in the Melbourne head office building. Each small square on the boards on the walls shows the loading of a particular flight. The clerk can tell at a glance whether seats are available or not on a flight on a particular date.



checks the serial number (to detect any missing messages) and "reads" the standard code address. The common equipment then selects the appropriate outgoing line for the particular office to which the message is addressed. If this line is free, the message is released to enable it to transit across the Switching Centre office — i.e. from the incoming to the outgoing "stores." On arrival at the outgoing line reperforator/transmitter, it is transmitted in the form of code impulses direct to the addressed receiving office. Immediately prior to transmission on this outgoing line, the message is automatically programmed and receives a new "channel identity" and serial number, a step which facilitates checking and tracing of messages.

At the distant office, the receiving teleprinter transforms the impulses back into the original letters, numbers and spaces, and it is typed onto paper copy.

In essence, therefore, each message is put through at least three stages of transmission — first from the sending unit to the centre, second from the incoming side to the outgoing side of the centre, and third from the centre to its destination.

To avoid undue line rental cost to some more remote locations, two subsidiary switching centres are in operation. These work on the same basis as the main centre, the largest being at Brisbane. Here lines are grouped for all airports north of Brisbane, thus saving the need for individual circuits to Sydney from airports such as Mackay, Townsville, Cairns, Coolangatta, Rockhampton and Maryborough. "Selective calling" devices ensure that through traffic addressed to a particular north Queensland airport is received at that machine only. Launceston, the second subsidiary centre, performs a similar function in respect of Hobart, Burnie and Devonport.

The choice of central automatic electro-mechanical switching equipment was made as a phased step forward in modernisation from the old manual relay system, and against immediate computerised switching, following a number of considerations, not least of these being the aspect of economy. Equally, the equipment would also be expected to cope well with the traffic the system was to handle during the system's normal life expectancy. Whilst a computer would do the switching job more quickly, enabling the central switching system to handle a larger number of messages, it would have been false economy at the time and advantages offset by the limited number of outlets. Computerised message switching will be used for this purpose eventually, but more about that later.

The entire network was installed in 1965 at a cost of $197,000 of which $125,000 represented the cost of the Central Switching Centre.

A point of interest is that the system uses the standard address codes of the International Air Transport Association. A message sent to the reservations department in Sydney would be addressed SYDRMTN. The first three letters (SYD) are the code-name for the port, the next two (RM) the code for the particular section, and the last two (TN) the international code name of Trans-Australia Airlines. The system is therefore completely compatible with all overseas air-

lines, and the same address system is used for a party booking from New York as would be for a simple message between Sydney and Melbourne.

Despite the efficiency of the auto telegraph network, a very great number of messages have to be exchanged for every flight that demands a freedom of expression and, because of this, direct voice communication between certain major airports has been established. Therefore the main ports on TAA's trunk routes are now connected by tie-lines — referred to within the airlines as the "Hotline" — enabling voice exchanges to be made without the delays often experienced with normal trunk-line calls. Certain key extensions at airports may dial direct to extensions at the far end, operator assistance being unnecessary. A direct line, which is rented from the P.M.G., connects Brisbane, Sydney, and Melbourne, with an additional direct line between the reservations offices in Sydney and Melbourne.

With flying times of less than one hour between these cities, and with a large number of messages to be transmitted for every flight, these voice communications are essential for maintaining good service and schedules.

To appreciate this fully, one must realise that a Boeing 727 T-Jet carries more than 100 passengers, and any or all of these may require any number of things to be done before they arrive at their destination. Also, the vital aspect of aircraft movement must be discussed freely between airports and, for this bulk of communications traffic that must all happen immediately, a conventional telegraph system is too slow.

Naturally, access to use of the tie-lines is restricted, and some officers have priority of use over others. Regular checks are made to ensure the circuits are not being used in cases where a telegraph message would have sufficed and also to check on the traffic trends of the system. In fact, the lines have

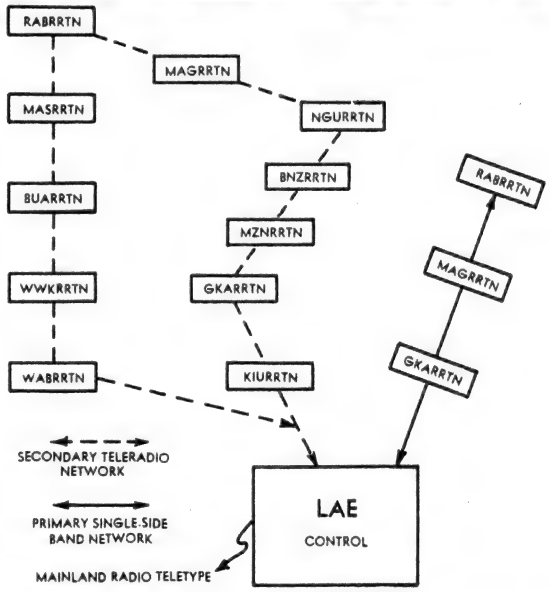
ABOVE: The teletype sending station attached to the main TAA message switching centre at Sydney Airport.

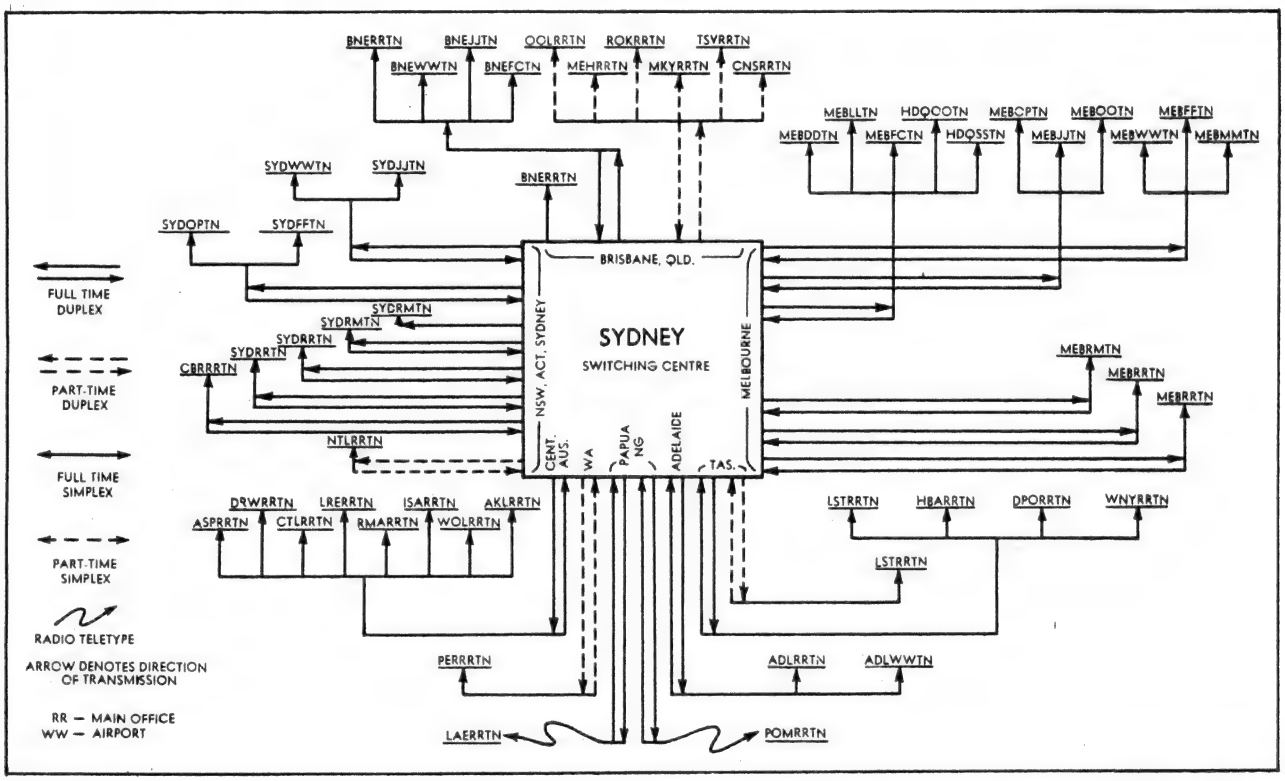
☆

CENTRE: TAA's extensive HF radiotelephone network in New Guinea.

☆

BELOW: Schematic diagram of TAA's widespread Telex network, based at Sydney Airport.





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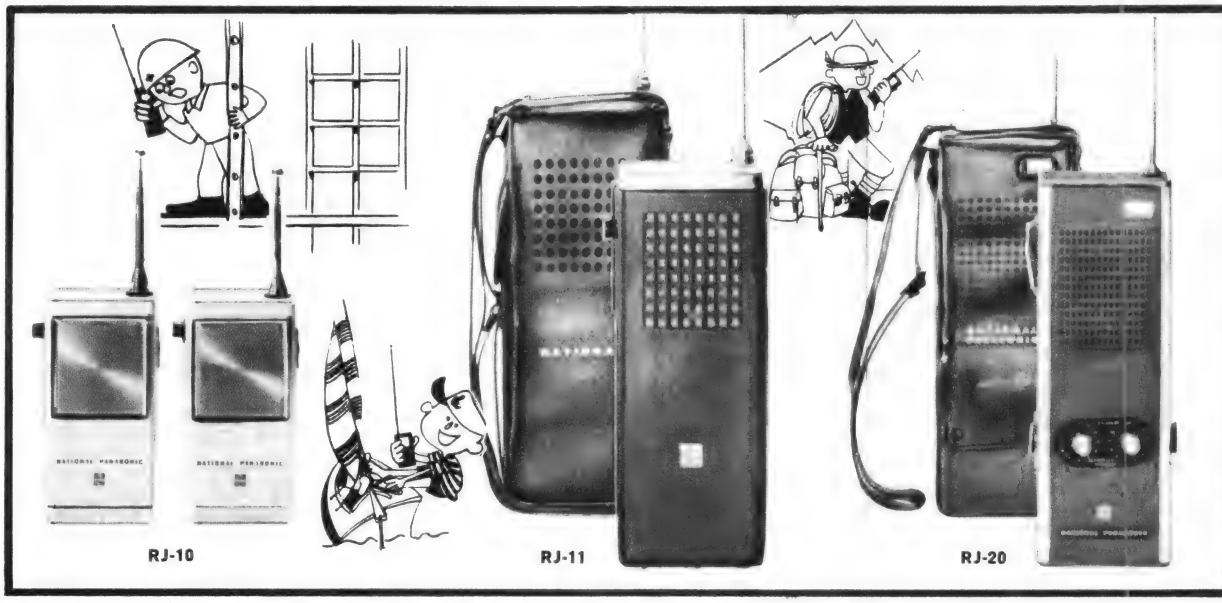
Transceivers and Loudhailers



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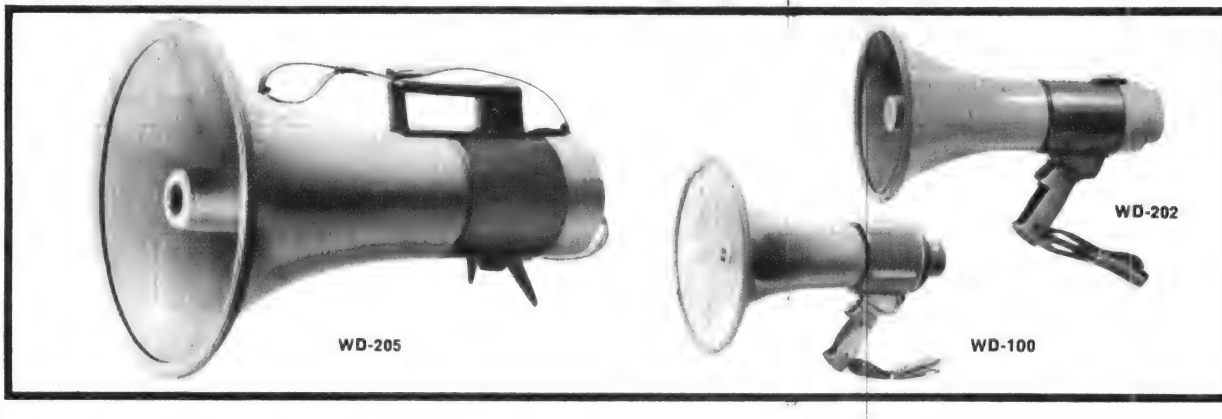

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TRANSCEIVERS

RJ-10: 8T, pocket size. Receiver output, 250 mW; final stage output, 100mW; 9 oz. 1 x 006P 9V battery. Ea. **$61.90.**

RJ-11: 10T. Receiver output, 280 mW; final stage output, 100 mW; 21 oz. without batteries, which are 6x UM-3. (9V) Extension power jack. Ea. **$70.50.**

RJ-20: 11T. Receiver output, 500 mW; final stage output, 500 mW; 29½ oz. without batteries (8 x UM-3–12V). Squelch control. Ext. power jack. Ext. mic. jack. Ea. **$139.95.**

LOUDHAILERS

WD-205: Output, 15W. 12V, runs on 8 'D' cells. Detachable microphone with switch. Volume control. 7lb. 5oz. **$125.00.**

WD-100: Output, 2W. 6V, runs on 4 'D' cells. On-off trigger switch 4lb. 3oz. **$45.00**

WD-202: Output, 10W. 9V, runs on 6 'C' cells. On-off trigger switch. 5lb. Volume control. **$78.80.**

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proved to be a most economical installation, although this was not the prime requisite of the service. They run to fullest capacity day and night. Continual investigation proceeds to enable TAA to evaluate the possibilities of extending this direct line hook-up to other major ports such as Adelaide.

By far the biggest general expansionary moves in the airline's communications system are being made to the standard telephone equipment at all offices, some allied to major building projects. It has been estimated that a bare minimum of five telephone calls are made for every passenger who makes a one-leg flight with TAA. With passenger traffic now approaching 2,000,000 a year, this means our telephone equipment must be geared to handle at least 10,000,000 calls a year or, in round figures, 200 calls a minute! This, of course, is exclusive of TAA's own internal traffic.

To cope with this, TAA is progressively modernising and expanding its switchboard and telephone equipment throughout the network and, as an example, the installation in the airline's new city terminal and head office building in Melbourne is among the most modern in the world. It is a Standard Telephones and Cables Pentaconta crossbar PABX system which was chosen to meet the immense demand of improved telephone services brought about by the large increases in passenger traffic.

Wrongly addressed, or mutilated messages are switched to this monitoring console, where the operator can manually make the required corrections and return the message into the automatic system, or refer the message to its originator for correction.

The equipment in the Melbourne office is similar in its operation and design, but larger, to equipment either installed or to be installed at the offices in Sydney, Brisbane, Adelaide, Perth and other offices. Additionally, further modern equipment in the form of an L.M. Ericsson ARD561 Crossbar PABX is to be installed at TAA's new Port Moresby office.

The Melbourne PABX has 35 incoming exchange lines, and another 49 into the Reservations queue circuits. The sophisticated equipment associated with the system enables incoming calls to be held, and another number dialled before either retrieving the call or transferring it automatically to another extension. Direct "in-dialling" is also facilitated; an outside caller may dial the first three digits of the published telephone number and then the number of the extension he requires, and thus obtain automatically direct connection to the extension.

The PABX is also equipped with 50 outgoing exchange lines, and 10 tie-lines from the city office to the airport and other outside places. It has a total capacity of 1,000 extensions, of which 636 are now in use with a further 87 "outdoor" extensions located at local TAA and agents' offices.

Special ancillary equipment has been provided for the Reservations-room function, enabling a very high degree of efficiency and service hitherto unavailable. Incoming calls proceed, via a separately advertised Reservations number, direct to the Reservations clerks. Special "queuing" and "gating" devices ensure that calls are handled in order of receipt.

The supervisor's console enables full monitoring of all incoming reservation telephone traffic. The number of queued "calls waiting" at any time is shown visually by meter display and the supervisor has the facility to transfer traffic between sections of the room, if necessary, to minimise customer "waiting" time, simply by pressing a button. A further service under the supervisor's control is the setting of a period at which the incoming call awaiting connection to the reservations clerk is referred to the PABX operator for supervision. Whilst being so referred, the call does not lose its position in the queue. This facility is an important facet and reminds callers that they have not been forgotten!

The cost of the PABX installation in the Melbourne building was $56,000 exclusive of standard office equipment (e.g. handsets). A further $15,000 worth of PABX equipment is to be installed at both Perth and Port Moresby. An amount of $30,000 has been allocated to update and renew the PABX, and where required, the telephone network, at Brisbane. This continuous expansion and improvement to equipment enables TAA to give first-class telephone service to its customers — after all, in the majority of cases, the telephone is our first customer contact — and facilitates the high standard of internal communications essential to the efficient administration of a modern, progressive organisation.

The message switching centre at Sydney Airport. Incoming Telex messages are transformed into perforated tape by the incoming machines, the message is electromechanically switched to the appropriate outgoing machine and automatically appears, almost instantaneously, as printed words on a receiving unit at the addressed station.

The third main group of the airline's ground communications is the various ground-to-ground and ground-to-air radio installations.

The most notable of these is the extensive radio network in Papua/New Guinea. The terrain and other factors in the Territory make HF radio-telephone communication the only practical transmission media at present. TAA is therefore currently equipped with 100W P-E-P single sideband transceivers at major airports operating on 7 and 3MHz; a secondary network utilises 35W AM transceivers working into the smaller offices and agencies such as Buka and Banz.

Lae is the control port for TAA's New Guinea operations and is also a terminal outstation on the TAA automatic telegraph network, being linked to the Message Switching Centre via leased OTC ‡-speed duplex telegraph channels. It therefore forms a vital junction for intersignalling between the New Guinea radio-telephone network and the mainland offices connected to the telegraph system.

The secondary network operates on 5-MHz and, to date, has been adequate for the type of volume of traffic which has been required to be handled. However, in future planning, TAA is looking towards the re-equipment of all ports with the most modern SSB equipment available.

The airline's other major use of radio communication, particularly valuable on fast, short hauls, is the company ground-to-air radio contact available between the terminals and the TAA aircraft approaching or leaving the airport. For this function, the company uses Pye PTC 2750 and F528 VHF 50W AM transceivers operating on 129.5MHz at the key airports of Sydney, Albury, and Canberra. Older equipment of a similar nature is now being replaced and updated at Essendon Airport, and another installation is under way at the moment at Mackay. Plans are also in hand to install the equipment at Eagle Farm (Brisbane Airport), Coolangatta, Launceston and Hobart and there is a potential for tremendous expansion in this vital field of communications that helps make the airline's operations more efficient.

Whether it's a booking for a Rent-a-Car, or a warning from the pilot that certain unscheduled maintenance will be required on arrival, the ground-to-air radio link has proved an invaluable aid.

But with all the sophisticated radio equipment, it is the smallest, lowest-powered radio equipment used anywhere in TAA that enables the airline to achieve fast turn-around times at airports. This is the radio link between the Dispatch Officer and the Dispatch Tarmac Controller. The Dispatch Controller sits at a desk in the air terminal overlooking the tarmac and parked aircraft. He is surrounded by radio transceivers, microphones and telephones. He is often referred to as the Flight Co-ordinator and it is he who is responsible for arranging loading of cargo and luggage, announcing the loading of the aircraft to the waiting passengers, and of ensuring that all passengers booked for the flight are accounted for.

The Dispatch Officer is the man who stands at the aircraft door holding a small walkie-talkie radio, and it is he who tells the Co-ordinator when the luggage holds are emptied so that loading can begin, and when the cabin cleaners are finished and passenger loading can take place. This small radio link does away with the need for the Dispatch Officer to waste time walking between the aircraft and the terminal up to six or seven times for each flight!

Other aspects of the Ground Communications Department's responsibility are the public address systems at passenger terminals, intercommunication installations, CCTV (Closed Circuit Television) and display systems and other equipment such as the compressed air tube carriers connecting various departments with each telegraph transmitting centre. In the past two years, to improve internal communications at both town office and airports, TAA has installed a number of expandable loud-speaking automatic intercommunication systems, complementary to the telephone systems. They, again, use Crossbar exchanges and provide fast push-button calling with hands-free conversation. Special facilities include conference and group calling. Systems in use are Communications Systems of Australia's "Centrum," Amalgamated Wireless (A'asia) "Sinus," and Comtel International's "Ringmaster."

The department thus has a vast range of electronic and associated equipment under its care that calls for a great deal of attention, evaluation and supervision.

With more than 60 major offices and a large number of agents around Australia and Papua-New Guinea in direct contact to the TAA network, one way or another, and with no room for delay or mutilation of messages, the airline is always looking for improvements to existing equipment or investigating and evaluating new electronic developments that may provide speed and accuracy of message handling.

With the ever-decreasing flying times and increasing passenger loads, some equipment becomes progressively less efficient, or overloaded. Typical are at least two public address systems at the larger TAA terminals which have to handle a very large number of messages relative to the arrival and departure of every flight. A possible way of easing the congestion, being investigated at the moment, is in the increased use of visual displays at a greater number of locations in the terminal.

Flight arrival and departure times and other announcements could be displayed on closed-circuit television and/or electronic data display boards, thereby greatly reducing the load on the public address system, and helping to overcome the psychological block that some of the travelling public appear to suffer when subjected to a continuous barrage of loud-speaker announcements.

Another addition to TAA's electronic family, now under consideration, is a reproduction network, which enables the message to be transmitted to distant receivers simultaneously with its being handwritten.

Probably the most invaluable change however, will be the introduction of computer message switching for the TAA telegraph network. Preliminary studies have recently been conducted and are continuing. The system finally chosen would be required to replace the existing electro-mechanical equipment of the Message Switching Centre and to be suitable for interconnection with Reservations and any other computer facilities which may exist.

With the continued close co-operation of the Postmaster-General's Department and industrial manufacturers, TAA will constantly study communications systems applications and advancing techniques to ensure the continuance of the highest possible standards of ground communications so that we may maintain with vigour our motto that TAA is truly the friendly way! ■

The Flight Co-ordinator (foreground) discusses the loading of an aircraft with a tarmac Dispatch Officer over a walkie-talkie radio. The Co-ordinator is also responsible for PA messages calling for passengers to board the aircraft, and is in radio contact with incoming and outgoing aircraft.

Studio C in the CBA building and, beyond, Control Room No. 2.

HOBBYIST'S DREAM BECOMES A REALITY

THE CHRISTIAN BROADCASTING ASSOCIATION

One of the busiest and most up-to-date organisations on the Australian broadcasting scene is one devoted exclusively to the production of devotional radio programs. Under the guidance of Rev. Vernon Turner, one-time hobbyist and Anglican curate and now an ordained minister of the Presbyterian Church, the Christian Broadcasting Association is currently supplying something like 500 program tapes per week for release on Australian commercial and overseas short-wave radio stations.

The Christian Broadcasting Association — CBA — founded in 1953, is a non-profit gospel broadcasting agency of the Churches. In its studios at Five Dock in Sydney it produces 500 programs every week for release on almost 100 commercial broadcasting stations throughout the Commonwealth, and a smaller number overseas. The organisation gives its programs to stations without charge, relying for its income on gifts from appreciative listeners. Stations in turn donate time without charge (valued in 1966 at more than $160,000).

CBA also trains theological students, ministers and missionaries in the art of broadcasting. It publishes a monthly magazine, "Radio Times," which lists religious broadcasts on all commercial stations.

The founder of CBA, Rev. Vernon Turner, has published a number of books including "God Gave Me a Microphone," and "The Art of Christian Broadcasting."

At an age when other small boys play with train sets, toy cars and similar shop-bought novelties, Vernon Turner made microphones from old telephones. Later he made crystal sets. In his final years at primary school he had advanced to a "studio" housed in a tool shed in the garden, equipped with two mechanical gramophones, several carbon microphones and a pair of headphones. His program "schedules" consisted of playing gramophone records, announcing commercials and reading the news (straight from the front page of the "Adelaide Advertiser"). Although later in life he was called to the ministry, he never lost his early interest in broadcasting.

Rev. Vernon Turner, who founded the CBA, has had a lifetime interest in electronics and broadcasting. The present editor of "Electronics Australia remembers assisting him with the construction of recording equipment when Vernon Turner was Catechist of Merrylands-Guildford parish. He has been broadcasting since 1942, and is known to radio listeners all over Australia.

Rev. Turner first became an active broadcaster in 1942, when he asked the Council of Churches in N.S.W. for permission to broadcast a "Church News" program from 2CH Sydney on Sunday afternoons. These programs commenced in November, 1942, and continued to the present day. Then, in 1949, when Rev. Turner was ministering at the Bulimba Presbyterian Church in Qld., he was invited by Station 4BC to take over the "Morning Devotions" program. It was a suggestion from the chief engineer of 4BC which led to the now famous "Sunshine Hour." The suggestion was for a community hymn singing broadcast from a church in Brisbane. The first "Sunshine Hour" was from the Ann Street Presbyterian Church, at 3 p.m. on February 4, 1951.

The program proved to be so popular that recordings were sent to other stations, and was eventually played by a widespread network of stations throughout Australia.

In 1953 Rev. Turner returned to Sydney to become editor of "The Australian Christian World." Before leaving Brisbane he had arranged with Station 4BC to send them tape recordings for the "Morning Devotions" program, so he set up a recording studio at the offices of the newspaper in Castlereagh Street. This had two turntables, a microphone and a mixer feeding two tape recorders. Later Rev. Turner made a disc-cutting lathe on which he made his own 16in discs for the "Sunshine Hour" programs. This equipment was primitive, but it worked well and produced sound of an acceptable quality.

Under Rev. Turner's energetic leadship, the "Australian Christian World" was making good progress, but unfortunately the financial backing failed after only a few months, and the paper ceased publication. Rev. Turner therefore turned all his attention to his broadcasting activities, and the CBA was formed. At this time he already possessed a professional microphone and tape recorder, purchased through the generosity of an appreciative listener and family friend.

In the latter half of 1953 he was offered premises at Darlinghurst which were larger and more suitable than the tiny Castlereagh Street studio. Here, with the aid of voluntary labour and technical assistance, Rev. Turner set up a small studio. After Rev. Turner vacated this building some months later, it became the Sydney Lifeline Centre, regrettably destroyed by fire only last month.

Since returning to Sydney in 1953, Rev. Turner had conducted the "Sunshine Hour" program from the Assembly Hall of Scots Church in Margaret Street. A second program was added — the "Wednesday Service" recorded at St. Stephen's Presbyterian Church in Macquarie Street, Sydney, with the Rev. Gordon Powell in charge. This program was first recorded in August, 1953 and was soon accepted by many stations as a regular feature.

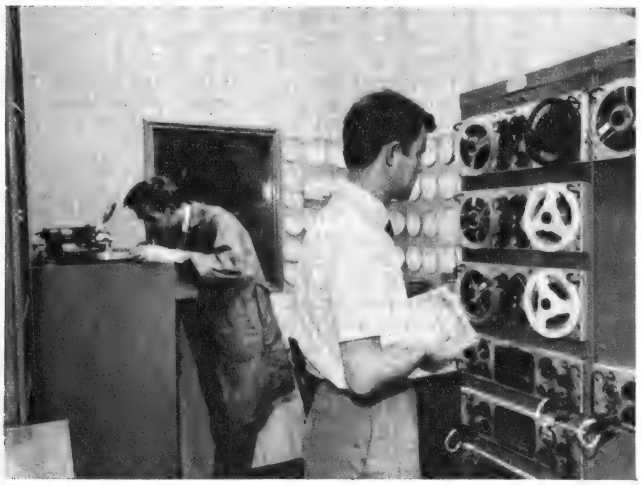
Rev. Turner returned to parish work in December, 1953, with the Abbotsford-Five Dock parish. The Five Dock congregation gave permission to use part of the church hall as a studio, control room and office. From then on, the "Sunshine Hour" was recorded at the Five Dock church hall. From this time on things began to develop rapidly. Rev. Turner had been assisted by a small staff for some time. Now he acquired a qualified tedhnician to act as his engineer, and an announcer with commercial radio experience. The demand for recordings grew, more donations came in and by 1959 the staff grew to 15 people. The accommodation was becoming hopelessly inadequate, and the equipment was reaching the end of its useful life, unsuitable for the large amount of work it was required to handle.

Having failed to find a suitable building in the Sydney area which could be converted into a studio, Rev. Turner decided they would have to build a new studio. When plans were completed, and estimates drawn up, it was found that the cost of building the studio and equipping it would be around $100,000. Somehow the money was found, and on March 6, 1960, the foundation stone of the new CBA studio was unveiled by the Governor of N.S.W.

The three studios in CBA's present building at Five Dock have all the technical facilities necessary to tape-record more than 500 program episodes each week for free distribution to the commercial broadcasting network.

Each studio "floats" on cork pads to absorb ground noises, and there are no ties between the inner and outer brick walls, providing further isolation. With 7in concrete ceilings and 9in concrete floors, the studios are solid and air-tight in order to exclude airborne noises. Sound attenuated air-conditioning ducts carry air to studios, control booths and offices.

Acoustic balancing within the studios is achieved by lining the walls with a two-inch thickness of rock wool, which is in turn covered with alternating panels of plain and perforated plywood. The plain wood reflects sound, and the perforated wood absorbs sound. In this manner the desired amount of "presence" is achieved in each studio, the proportion being worked out in relation to the "body-load" or the number of persons who usually work in them. Special timber panels on end walls are designed to resonate in the middle audio frequencies, to assist singers and instrumentalists. These "tuned" studios remain pleasantly "bright" provided the maximum number of people for which they were designed is not exceeded.



On this tape duplicating machine capable of simultaneously making three tapes from the master tape, some 500 program episodes are made each week for distribution to a network of commercial stations all over Australia. When discs are required instead of tapes, these are made on the disc-cutting lathe to the left of the picture.

The No. 1 control booth at the Fivedock studios is fully equipped to professional standard, with production panel, rack mounted tape recorders, disc reproducing equipment and tape cassette reproducer.

Studio furnishings are simple. The large studio "A" has a piano, Hammond organ and vibraharp as standard equipment, with microphones suspended from a special aluminium grill fixed to the ceiling. No floor stands are used, and all microphones can readily be moved to any part of the studio. Each wall has an escutcheon containing two microphone inlets, remote control plugs, tape recorder plugs and talkback facilities. These wall escutcheons are standard in all studios.

Studio "A" is used for recording vocalists, intrumental groups, and medium sized choirs and audiences. Artists are controlled from the control booths by a talkback system and by illuminated signals.

The two smaller studios, "B" and "C," are furnished with special desks and microphones to cater for talks, interviews and routine presentation announcing. All the audio facilities and signals used in Studio "A" are reproduced in "B" and "C."

Studios and control booths are separated by three large sheets of plate glass mounted at odd angles and distances to minimise resonance. Excellent visual communication is possible through these big windows, aided by two-way talkback, foldback (split studio monitoring) and other facilities.

Tape recordings are made in the control booths on rack-mounted Rola machines, manufactured by the Plessey group in Melbourne. CBA uses the Mark II and Mark III models for original recording, editing and duplicating. The Mark II recorder is excellent for sub-editing purposes, and the Mark III shines as a fast starter! All machines throughout the building may be coupled together and supplied with a common signal for rapid duplicating and all may be started and stopped by remote control buttons. Normal tape duplicating is done on a special rack-mounted array of Mark II slave decks fed by a full-track master model 66.

Each control booth is furnished with a waist-high desk fitted with four Rola 12in turntables, four Commonwealth Electronics magnetic pickups, and a large mixing console, built by E.M.I. Ltd.

The console provides for mixing twelve primary audio channels, with switched splits for foldback and echo functions. Each channel has its own fader, and a master fader controls the entire output of the console. Two VU meters are provided to monitor either the Number One channel or a parallel Number Two channel, which can be used as the second channel for stereo. From the same console all tape recorders, pickups and lines can be monitored audibly and visually (on VU meters) through an audition key, and remote control buttons can control all recording functions throughout the building.

Pickup cueing is achieved by pressing a self-returning button alongside each turntable, which throws the pickup from the mixing console to a special cueing amplifier. Cueing,

(Continued on Page 173)

TRANSPORTABLE SATELLITE STATIONS and Modular Radar Systems

New developments in the radar and military communications field have been announced by The Marconi Company Ltd., of England. The new radar equipment allows almost any civil or military requirement to be covered by using a basic range of radar heads, transmitters and other hardware. The communications stations can be quickly dismantled for transportation by air to a new site.

Three of the military communications stations are already in service. They have been constructed and commissioned as the British terminals in the Anglo-American Initial Defence Communication Satellite Project. The stations are located in southern England, The Middle East and the Far East, and form an essential part of a global network operating through seven satellites placed into orbit in June last year.

A key feature of these stations is that despite their size they can be quickly dismantled, air-lifted to a new destination and reassembled in a matter of hours. The aerial can be dismantled into sub-units which will fit the freight holds of Belfast or Hercules transport aircraft, and the 60ft high radome which houses the complete station is a double-walled air-inflatable structure which can be collapsed and stowed in the aircraft.

The electronic and control units, including the control computer, are all housed in container-type cabins which are air-conditioned, thermally insulated and interconnected by plug-in cables. The only preparation required for air transportation is to un-plug the cables and close the cabin doors.

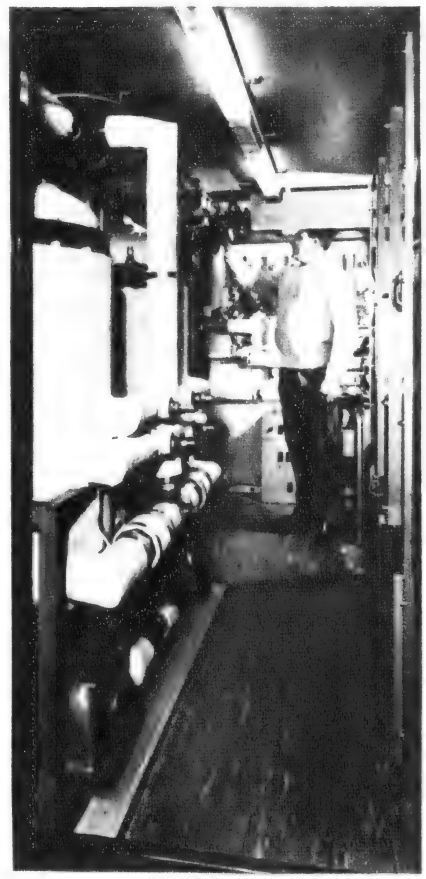
Although designed for a high level of mobility the engineering specification is as good as the finest permanently based stations. The critical surface profile of the 40ft diameter aerial paraboloid, for example, is within 10 mil (1/100th of an inch) of a true parabola at distances up to 20ft from the centre and is within 25 mil at the extreme edges. The reflecting surface is constructed from 2in-thick aluminium honeycomb sandwich panels on an aluminium backing framework.

The aerial is driven in elevation and azimuth by electric motors controlled by tracking information from the receiving system once the satellite signal has been acquired. In the preliminary stages of acquiring a satellite the aerial direction is controlled by a Myriad microelectronic digital computer which is fed with orbital predictions on paper tape. The aerial then scans the area of sky with continuous motion until the first signals are received, after which the normal automatic tracking system locks on to the target and follows the satellite for the whole period until it disappears over the horizon.

During operation, the computer also introduces a variable time delay in the system depending on the distance of the satellite from the ground terminal. The effect of this arrangement is that all signals appear in the system as if they emanated from a satellite at a fixed range of 25,000 miles, irrespective of the actual range. This provision enables transfer of high-speed digital data from one satellite to another with no break in transmission.

The transmitting system employs a five-stage cavity klystron driven by a travelling-wave-rube amplifier. The receiving system has a two-stage parametric amplifier cooled to 20 degrees K (minus 253 degrees C) by a helium refrigeration system to reduce the noise temperature. Four separate waveguide horns are used for receiving to give a sum signal for the receiver proper, and a difference signal from opposite pairs of horns to control the automatic tracking system.

Naturally the performance of the new military stations is wrapped in secrecy but it may be assumed it will not be less than a comparable civil system built by The Marconi Company for Cable and Wireless Ltd. on Ascension Island, for a vital communications link in the Apollo Man-on-the-Moon project. This station will be in direct contact with Andover, Maine, U.S.A., through a synchronous satellite stationed over West Africa. From Maine the transmission will be routed to Apollo Control at Goddard Space Flight Centre in Maryland.



Interior of the transmitter cabin of the military satellite communication station.

Because of the importance of this link the major elements of both transmitter and receiver are duplicated and in the event of any failure the standby units are automatically switched into circuit in 0.2 second.

Transmission power of this station is quoted at 15KW on a frequency of 6000MHz. The receiver, which operates at 4000MHz, has a similar helium-cooled parametric amplifier to provide low-noise reception.

The new "modular" radar equipment is named the S600 Series. It comprises 12 different types of aerial heads, five different transmitter-receivers and a wide range of signal processing equipment. The Marconi Myriad computers can be integrated with this basic equipment as well as data displays, to provide advanced data handling facilities to any system.

Different combinations of the equipment can be used to form radar systems covering any of the following functions —ground control of interceptors (G.C.I.), tactical control for weapon systems, early warning and reporting, general air surveillance, military or civil air traffic control, coast watching, etc. Civil air traffic control systems, ranging from simple, medium-range air traffic surveillance to highly complex air traffic control by computer, can be supplied.

A number of the radar heads in the S600 Series have been specially designed for rapid transportation. Complete aerials, built on to wheeled chassis, have been designed with sections of the aerial folding away to form a very compact package which can be stowed in most of the military transport aircraft currently in use. The electronics can be built into mobile containers with removable wheel units for stowing in an aircraft. A complete height finder of surveillance radar installation can be transported across country, towed behind a vehicle such as a Land-Rover. Such a convoy can be taken by a single large transport aircraft and all the units are sufficiently compact and light to be lifted by existing military helicopters.

The containers which house the electronic equipment will take any two S600 transmitter/receivers and associated signal processing equipment. Alternatively with only one transmitter, a single container can house data handling and display equipment. For example a complete coast watching radar system with display equipment can be built into one container. A complex system having two surveillance radars and two height finder radars, all with two transmitters operating in diversity, would be housed in only four containers, although additional containers would be required for display equipment.

Any static system built up from these modules is highly adaptable. A customer who at first has need for only a basic installation can, at a later date, add on extra facilities, the original equipment being completely compatible. ■

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The "Celestion" Deluxe Model CX2012 is rated at 20 watts RMS and frequency response is **conservatively quoted** as 30-18,000 Hz. A special "Brilliance" control operates in the tweeter circuit — the electrical cross-over is at 4 kHz. See reviews in the "Gramophone" p.511, April, '65, and "Hi-Fi News" p.75, June, '65. ENCEL PRICE: CX2012 ..... **$59**

MODEL CX 1512 — A 12" HIGH FIDELITY CO-AXIAL LOUDSPEAKER

The Standard Model CX1512 has a frequency response **conservatively quoted** at 30-15,000 Hz. and is rated at 15 watts RMS.

See reviews in the "Gramophone" p.511, April, '65 and "Hi-Fi News" p.75, June, '65. ENCEL PRICE: CX1512 ..... **$39.50**

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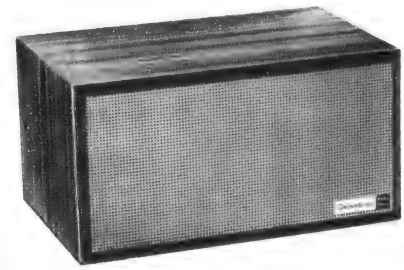

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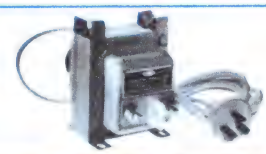

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ULTRA-THIN PLASTIC FILMS FOR MICROCIRCUIT INSULATION

A new group of polymers (chemically changed plastic materials) created by a scientist at the General Electric Research and Development Centre, New York, can be produced as films only a few millionths of an inch thick. One of the applications for the new polymers is as a superior electrical insulation for microelectronic devices.

The revolutionary polymers were described at the recent 14th Canadian High Polymer Forum, held in Quebec, Canada, in a paper presented by Dr A. Nelson Wright, a physical chemist at GE's Research and Development Center.

One of GE's new polymers is formed from hexachlorobutadiene — an inexpensive (about 20c per pound) and common chemical that is not subject to conventional forms of polymerisation. Pinhole-free films of this polymer have been desposited successfully upon silicon, aluminium, stainless steel, tin, lead, gold, niobium, and many other surfaces. Although these films are only a millionth of an inch thick, they are electrically and mechanically continuous — and also exhibit excellent adhesion to the substrate.

GE's new plastic material is the first known example of a completely chlorinated polymer, and it shows excellent thermal stability in the presence of oxygen.

Dr Wright also has been able to deposit films from tetrafluoroethylene (TFE) gas, which is also the starting material for commercial non-adherent surfaces. Using the photodeposition technique, however, TFE material can be deposited for the first time in a continuous thin-film form.

One major application for thin films is as electrical insulation in microelectronic devices, such as integrated circuits—now being used increasingly in many electronics applications, in equipment as simple as radios or as complex as computers. Conventional materials used in this way are porous and often do not adhere satisfactorily to the substrate. GE's new thin-film polymer, by contrast, surmounts both problems.

The new polymer is produced by the photodeposition technique. In this process, the polymer coating is applied in gaseous form inside a vacuum chamber. After the object to be coated has been placed inside the chamber, the air is pumped out and hexachlorobutadiene gas is introduced into the system. When the system is irradiated with ultraviolet light, a polymer film is deposited upon the surface of the object. The thickness of the film depends upon the time of the ultraviolet irradiation.

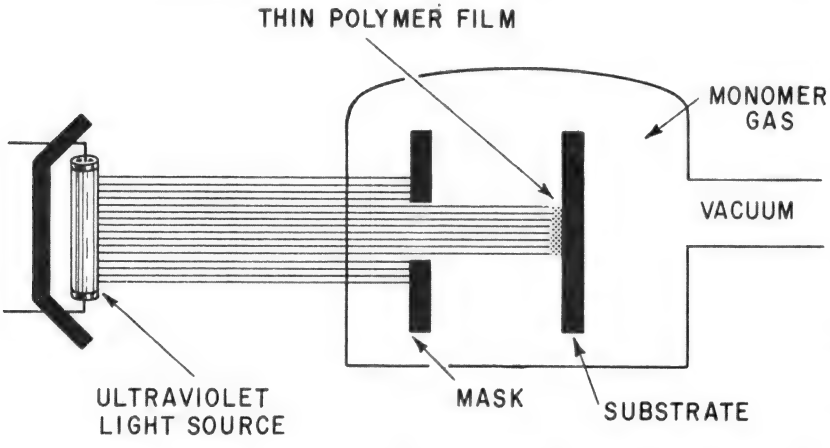
If a mask is placed in front of the substrate, an extremely well-defined pattern can be formed upon it. In this way, for example, the new polymer has been deposited in various configurations.

The photodeposition process also solves the problem of making polymers "stick" to metallic and other surfaces. The surface of the substrate interacts with the gas before polymerisation begins, thus promoting a high order of adhesion between the polymer film and the substrate. The substrate does not have to be freshly prepared.

"The General Electric Company is a pioneer in the 'tailor-making' of unique plastics to fill requirements that no other materials can satisfy," said Dr Arthur M. Bueche, GE vice-president in charge of the company's Research and Development Centre in Schenectady, N.Y. "In recent years, this work has resulted in the invention of PPO(R) and Noryl (R) thermoplastic resins, now being manufactured near Albany, N.Y., in a new plant with a capacity of ten million pounds per year, as well as a new family of plastics that conduct electric current. The invention of new thin-film polymers may provide a whole new area for potential growth in the use of plastics."

The new plastics will require additional development before they become commercially available. Patent applications for the family of polymers have been filed in Dr Wright's name. ■

Dr. A. Nelson Wright, the General Electric research scientist who created the new group of polymers, studies the apparatus he used for depositing films only a few thousandths of an inch thick. The polymer coatings are applied in gaseous form inside a vacuum chamber similar to the one shown here. When the system is irradiated with ultraviolet light, a polymer film is deposited upon the surface to be coated. patterns can be formed on a substrate by means of masks, as shown in the schematic diagram below.



This diagram shows the general arrangement for forming deposited patterns of the new polymers on a substrate material. The substrate is placed inside the vacuum chamber, the air is pumped out, and a monomer gas is introduced into the system. When the system is irradiated with ultraviolet light, a polymer film is deposited upon the surface of the substrate. The thickness of the film depends upon the time of the ultraviolet irradiation. If a mask is placed in front of the substrate to prevent light falling upon sections of the surface, the screened areas remain uncoated. In this way conducting paths can be formed upon a substrate coated with a conducting material.

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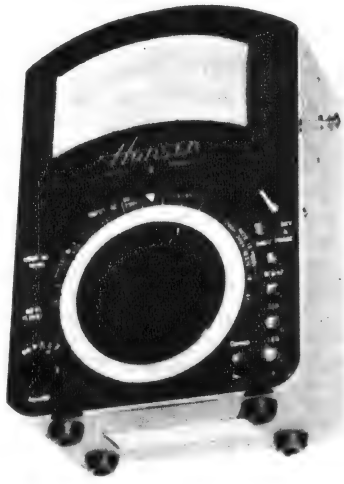

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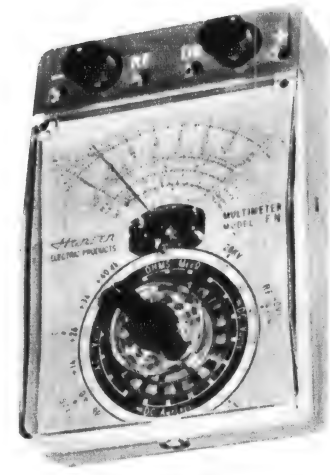
Decibels: —20 to +59
RF Volts: 0-14 rms: 0-40 p-p



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JM8/67

Technical Review

LIGHT BEAMS GUIDE AIRCRAFT AND AIM GUNS

In U.S.A., Honeywell Inc. has developed a system that literally requires that a pilot use his head to control a helicopter's navigational computer, armaments or reconnaissance photographic equipment.

The aiming system, developed by the Systems and Research Division in Minneapolis, is being proposed for use on the U.S. Army's newly developed AAFSS (advanced aerial fire support system). The first production models of this helicopter are expected to fly shortly, and the Army plans to test the Honeywell aiming system some time in June.

Completely controlled by head movements, the system reportedly reacts fast enough to track a target while the craft is flying as fast as 660 knots or at altitudes as low as 150 feet.

The basic idea for such a hands-off control is hardly new, but earlier designs lacked the required accuracy and manoeuvrability. Further, older units had a mechanical link between the pilot and the steering mechanism which limited the pilot's movements. The Honeywell system's link is a beam of light.

The system consists of a target sight attached to a plastic band which fits over the pilot's helmet, four photodetectors (two on each side of the helmet), two low-intensity light sources (one on either side of the cabin) that produce rotating beams, a small special-purpose computer, and an on-off switch for the system.

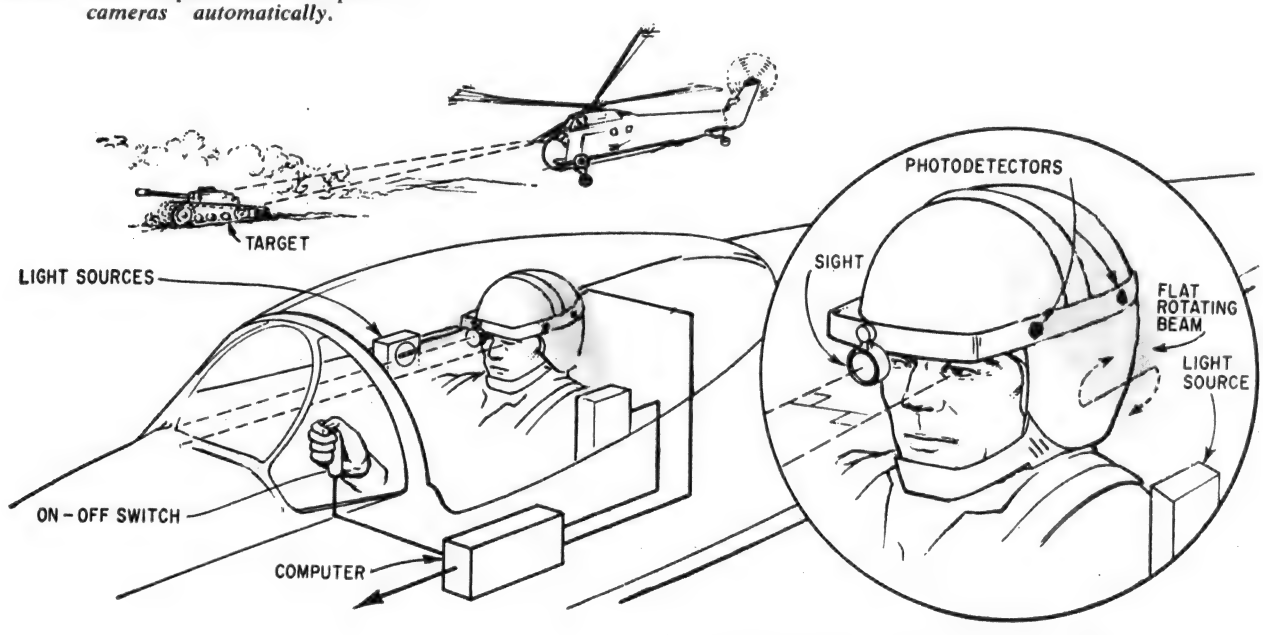
To aim the system, the pilot merely sights the target through his eyepiece and flips the switch. This action aligns the navigational system, the armaments, or the cameras on to the target. Naturally, though, he must not view the target out of the corner of his eye—he must sight it head-on.

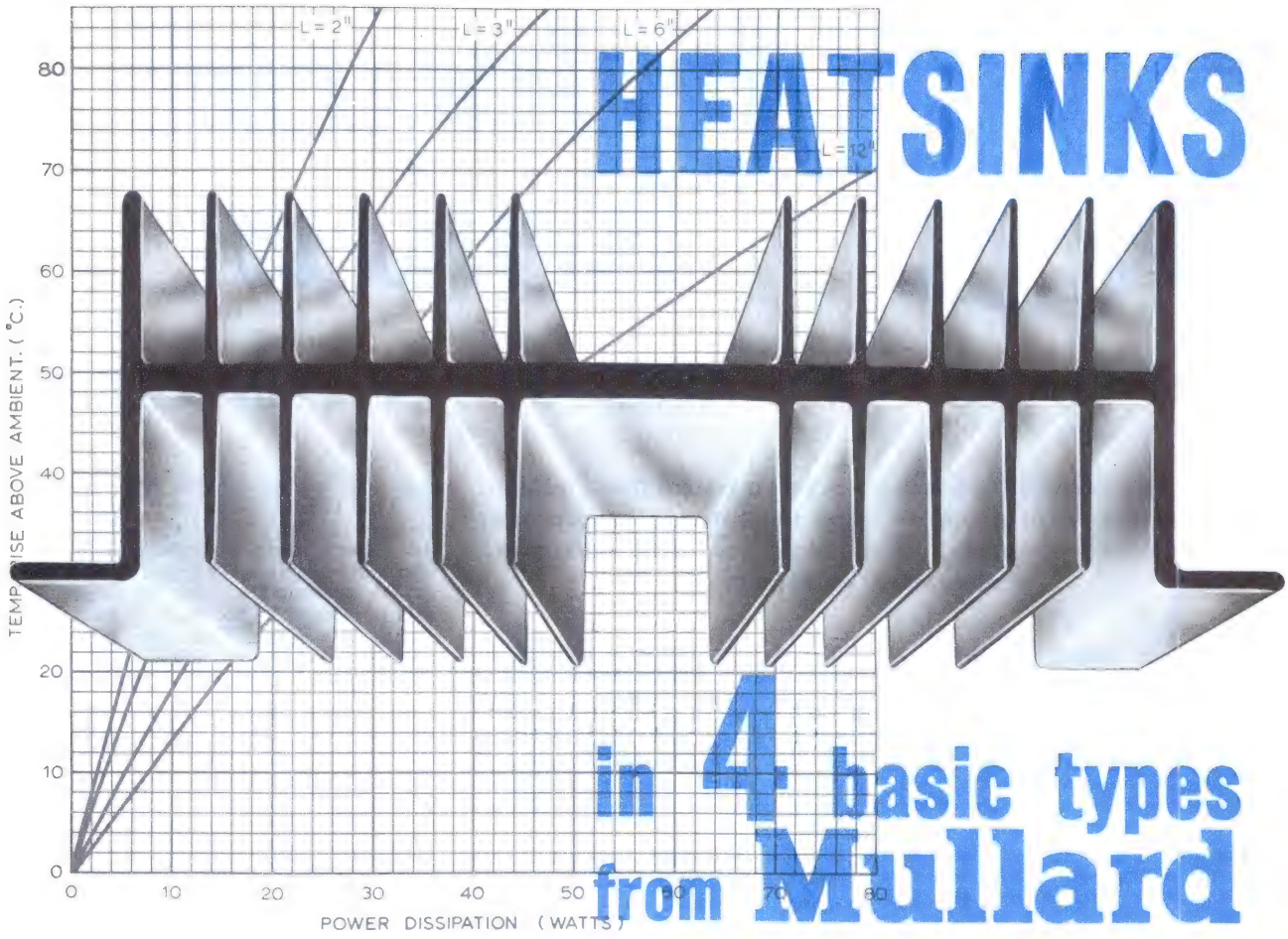
The spatial relationship between the four sensors and the two light sources provides all the information necessary to calculate the position of the pilot's head and to establish the line of sights to the target. Since the lights are clamped to the sides of the cabin, only the sensors move—in tandem with the pilot's head motion. The sight is mounted on the headband so that its projection axis is parallel to the axes of each pair of photodetectors. Thus, the pilot can adjust the sight in any axis without affecting the alignment of the system.

As the two lights spin around, their thin beams hit each detector in sequence; the time interval between the triggering of each sensor is a measure of the angle between each light source and each pair of sensors. Hence the position of the pilot's head relative to the light sources is calculated by simple trigonometry.

The angle resolving computer is designed with digital integrated circuits; it translates the time intervals into angles and subsequently into azimuth and elevation signals for the aiming mechanism of the weapons or cameras. A headband unit weighs 13oz, while the total system with sufficient hardware for two headbands (one for the pilot and one for the co-pilot) weighs 35lb. ("Electronics" Vol. 40, No. 6.) ◘

When the pilot has lined up the target in his sight, he operates an ON/OFF switch. The computer aims weapons or cameras automatically.





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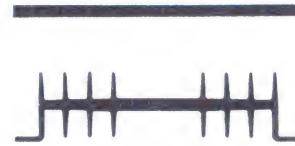
45D	3" 4" 6"	Anodised
55D	4" 6" 8"	Anodised
65D	4" 6" 8"	Plain

Bulk material is available in 36" and 72" lengths. Non-standard lengths, subject to quotation, can be supplied in minimum quantities of 100 pieces. Further details are available from Mullard offices throughout the Commonwealth.

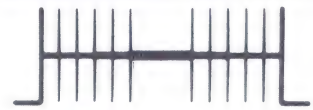


1 35D

For use with lower power transistors and silicon diodes.

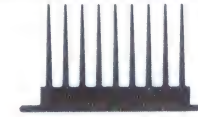
2 45D

For use with medium power transistors, thyristors and silicon diodes.



3 55D

For use with high power transistors, thyristors and silicon diodes.



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M204

DOFIC—A NEW APPROACH TO SEMICONDUCTOR TECHNOLOGY

Integrated circuits, which at present use an inter-connected assembly of many transistors, diodes and resistors, may soon be fabricated using the bulk properties of a crystal rather than the potentials at a series of p-n junctions. The researchers have called this new device a Domain Originated Functional Integrated Circuit. (DOFIC).

by C. P. Sandbank (Standard Telephone Labs.)

In certain semiconductors, high-field bulk effects which occur can be used to produce solid state devices that overcome some of the limitations found in p-n junction devices when operated at microwave frequencies. More recently, experiments carried out at Standard Telecommunication Laboratories, have shown that, in addition to the microwave applications, solid state bulk-effects can play a much wider role in electronics of the future.

The essential property of the bulk effect semiconductor or DOFIC is that at high fields it should exhibit a tendency towards negative mobility. In these circumstances, the carriers rearrange themselves in such a way that a high field domain is formed and sweeps through the crystal. It is possible to obtain very narrow domains travelling through the crystal over distances which are long compared to the width of the domain. There are several basic physical mechanisms giving rise to the formation of high field domains, and between them, they give a wide range of domain velocities. For example, domains due to field dependent trapping effects can move as slowly as one centimetre per second, whereas electron-phonon interaction gives domain travelling at the velocity of sound in piezo electric semiconductors such as cadmium sulphide.

The more familiar electron transfer from the light to the heavy effective mass states in gallium arsenide produces domains travelling at up to 10^7 centimetres per second. The possibility of making bulk effect integrated circuits arises from the fact that the domain can be made to interact with variations introduced into the drift path, and thereby synthesise complex electronic circuit functions. In the DOFIC no conventional components are identifiable and hence, unlike the more familiar present-day integrated circuits, it cannot be described in terms of a recognisable equivalent circuit.

It is, therefore, necessary to explain the operation by referring directly to the electronic function to be performed. The characteristics of most electronic circuits can be expressed in the terms of a waveform where one essential parameter such as current, is plotted as a function of time. This waveform is normally the basic invariant characteristic of the circuit, but the state at any instant may be determined by the input.

The basic characteristic of the DOFIC is derived from inhomogeneities which are introduced into the drift path between the cathode and the anode. The inhomogeneities are "read" by the domain as it sweeps through the crystal.

The inhomogeneities may be obtained, for example, by varying the cross-section of the drift path. The variations in cross-section will then appear as variations in current as the domain traverses the sample; thus any desired waveform may be synthesised by suitably shaping the crystal. Other methods, such as localised diffusion which varies the doping of the semiconductor, may be used to produce the desired profile.

Furthermore, it is not necessary that these variations be permanently built into the device: for example temporary changes can be induced by photon initiated ionisation.

We have, therefore, the essentials of a complex wave-form generator in which the waveform may be permanently programmed into the device, or it may be produced as the result of a changing photon image as in the television camera tube. (See below.)

In a really complex electronic circuit it is necessary, not only to generate the waveform, but to be able to select any portion of it at the command of the input. In the DOFIC, this may be achieved by using the input to control the length of the drift path traversed by the domain.

A simple analogue-to-digital converter illustrates this, in which the digital code was produced by varying the area of a cross section of the drift path. The analogue law was superimposed as a taper carrying an additional variation of the cross section. This taper causes the length of the drift path traversed by the domain to be a function of the analogue input.

Although only very simple devices have been made so far, they demonstrate the possibility of using bulk effects to realise, in a single drift path, electronic functions which would normally be performed by a really complex integrated circuit with many component elements.

It must be emphasised that the DOFIC is still in the research phase, and that many problems remain to be solved, particularly in view of the severe demands which bulk effect devices make on the quality and properties of the semiconductor. Nevertheless, the DOFIC represents a fundamental change in the direction of integrated circuit concepts. Whereas the "conventional" integrated circuit is a considerable technological achievement in enabling thousands of components to be manufactured on a single crystal of silicon, it represents little advance from the point of view of the electronic network. And except for ease of interconnection, the IC does not really take advantage of the fact that all the components are situated within one semiconductor crystal.

The bulk-effect integrated circuit, on the other hand, breaks new ground by using the distributed properties of the semiconductor to synthesise the desired electronic function directly. On the face of it, this seems the next logical step in the development of the integrated circuit concept. ("Electronics Weekly," 24/5/67). ■

DOFIC IMAGE—SENSING PANEL

A solid-state image sensing panel for television cameras with scanning performed by electrical field domains travelling through the bulk semiconductor was one intriguing possibility hinted at during a conference on integrated circuits held at Eastbourne, U.K., recently. The idea is an extension of the DOFIC concept (see above) and was revealed by C. P. Sandbank of Standard Telecommunication Laboratories who is largely responsible for the fundamental approach to "molecular electronics."

In the DOFIC the travelling domains "read" a conductivity pattern impressed into the GaAs semiconductor, so converting the spatial pattern into a variation of current with time. The conductivity profile, however, can be produced by means other than a permanent built-in structure—in this case by a temporary pattern of incident light. Here, the conductivity of the drift path is locally modified by extra current carriers excited by the incident photons. A suitable scanning rate could be achieved since the domains can be made to travel at velocities from 1cM/sec to 10^7cM/sec.

This "analogue" approach has not been developed to anything like the same extent as the "digital" solid-state image sensing panel using an array of photodetectors with scanning by X-Y addressing, as exemplified by RCA and Plessey, but Sandbank did reveal that he had obtained crude video signals from a DOFIC device. He felt that the complications of the computer-like circuitry in "digital" devices might be a disadvantage, and questioned whether this technique was really going in the right direction.

("Wireless World," June, 1967.)

SELECTIVE MOVING TARGET INDICATION FOR AIRPORT RADAR

Some of the limitations of Moving Target Indication (MTI) used in airport radars are overcome with a new system called Selective Moving Target Indication (SMTI), developed in the U.K. by the Solartron Electronic Group.

By R. N. Harrison

The need for Selective Moving Target Indication springs from the fact that use of cancelled video (MTI) has some serious disadvantages, the most obvious being the fading which occurs when an object moves tangentially to the radar line of shoot. To understand these disadvantages it is necessary to understand how MTI works and what the requirements are that it is designed to meet.

An air-traffic controller is primarily concerned with radar returns from aircraft. In its basic form, a radar set accepts returns from anything that will reflect its transmissions, which means that houses, trees, hills, factory chimneys and the like will all appear on the screen as clutter. This clutter appears chiefly in the centre of the picture, extending to five, ten or even twenty miles out, depending on the terrain; beyond that range there are isolated patches of returns, which may be up to 40 or 50 miles out but which are probably limited to one or two narrow sectors.

As it is not possible to distinguish between aircraft returns and permanent echoes on the basis of signal strength (the strength of the return from permanent echoes is generally greater than that from an aircraft), a system of discrimination based on movement was devised, the signal returns from each pulse being stored and compared with those of the succeeding pulse. If there is no phase change, the circuit assumes that the object producing reflection is stationary and should not, therefore, be reproduced at the display; instead this part of the signal is cancelled and not shown.

If there is a phase change, however, the object is assumed to be moving and is passed to the display for reproduction. Because responses from stationary objects have been deleted, the signal being fed from the MTI circuit to the display is called "cancelled video."

In order to achieve a phase change, there must be a radial component of movement. This means that an aircraft which is flying tangentially to the radar transmission is not recognised as a moving object, and its return is not included in the cancelled video signal fed to the display. There is a similar difficulty when the radial component of the speed of the object coincides with what is called the "blind speed," i.e., that speed at which there is no phase shift between the compared signals because the displacement is a precise number of cycles. The MTI circuit treats this effect as a return from a stationary object. The use of MTI is an expediency, and it is customary to gate its operation at the lowest range at which the majority of the permanent echoes are eliminated. This means that there is a circular area at the centre of the picture in which cancelled video is used, while outside this area uncancelled video ("raw radar") is displayed. Permanent-echo patterns are usually far from circular, so the choice of a grating range is a compromise between the elimination of all permanent echoes and the use of cancelled video over large areas covered by the system where there are no permanent echoes.

The purpose of the selective MTI technique is to limit the operation of MTI to those areas where there are actually permanent echoes, and to use uncancelled video everywhere else. There is thus established a requirement to switch between cancelled and uncancelled video during each radial movement of the scan, such switching being either a single change or cycled several times, depending on the complexity of the permanent-echo pattern.

SMTI has as its basis a normal video map, or a single channel of a dual-optic video map, the video-map plate used being a photographic analogue of the permanent echoes occurring at the particular radar site. All echoes are of the same strength and are represented on the plate by clear emulsion, the rest of the plate being opaque. When the flying spot scans a permanent echo, light is transmitted to the photomultiplier and induces an output voltage; as soon as the movement of the spot carries it beyond the permanent echo, the light is cut off and the output from the photomultiplier falls. Thus an output voltage from the photomultiplier corresponds to the occurrence of a permanent echo and indicates the need to use cancelled video; the absence of a voltage corresponds to an area without clutter, in which case uncancelled video can be used. The output from the photomultiplier is amplified and processed to produce a switching waveform, after which it is fed to a solid-state switching circuit.

A prototype switching unit is currently in operation at the London Air Traffic Control Centre, and was used in trials associated with the Marconi S.264 radar at Ash. The siting of this radar is such that traffic in Airways Red 1 and Blue 29 in the region of Clacton is flying tangentially, and tends to disappear at the time when it should be reporting.

Originally, permanent-echo plates for SMTI were produced empirically by scratching an exposed (and developed) photographic plate with a knife. When map evaluation was being carried out by the Canadian Department of Transport at Carp, Ontario, it was decided that a more accurate method of producing the permanent-echo plates should be used. Three photographs were taken of the permanent-echo pattern, with a short time interval between each to show up movement; all moving returns were then eliminated, and the remainder were transferred to a scaled-up drawing prepared in the same way as a normal video-map drawing.

When this plate was used at Carp, it became apparent that insufficient allowance had been made for the variation which occurs between the maximum and minimum permanent-echo patterns. Under different weather conditions, the returns from objects on the ground varied considerably, and the photographs probably represented a minimum level of permanent-echo reflectivity rather than a maximum. Another difficulty, which had been appreciated when making the permanent-echo drawing but had not been completely overcome, was the lack of circularity in the PPI (plan position indicator) sweep. This lack of circularity was apparent from the rangemarks, which could most fairly be described as "somewhat oval" and although calculations had been made of the displacement of the permanet echoes thus induced, they had not been sufficiently accurate.

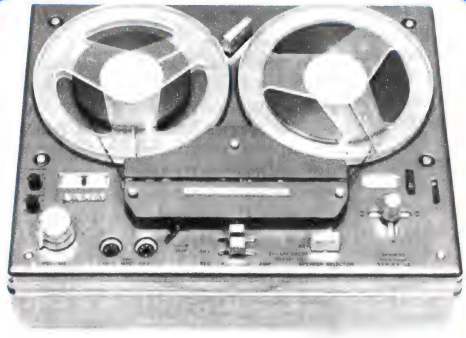
The permanent-echo plates now being produced represent the pattern of clutter, but they do not delineate individual permanent echoes unless these are well isolated from other returns. This ensures that seasonal variations in reflectivity will not affect the picture, and the cost of preparing the plates is thus reduced.

Nowadays, provision is made for displaying to the controller the pattern of permanent echoes which is being used, showing him in what areas he may expect tangential fade or blind-speed effects, and what areas will be free of them. To do this, the output from the head amplifier of the SMTI channel is repeated as a separate video signal and fed to the controller's display; there is a gain control associated with this circuit, and in using it the controller can bring up a background of fine-grain noise. As an alternative to this, it would be possible to display the permanent-echo area in outline, but the background method was chosen in order to avoid possible conflict with the use of contours for displaying weather information. ("Industrial Electronics," April, 1967.) ■

Tandberg

The popular Tandberg "Series 12" | and the new Tandberg Model 6X!

The name Tandberg is synonymous with precision engineering, completely natural sound reproduction and advanced tape recording technology. The "Series 12" has already established an enviable reputation as a completely self-contained stereo system; the new Model 6X Stereo Tape Recorder has been developed with the perfectionist in mind. Nothing has been spared to make the 6X the most effective, efficient and versatile tape recorder available in the world today. Both models proudly carry the Tandberg name.



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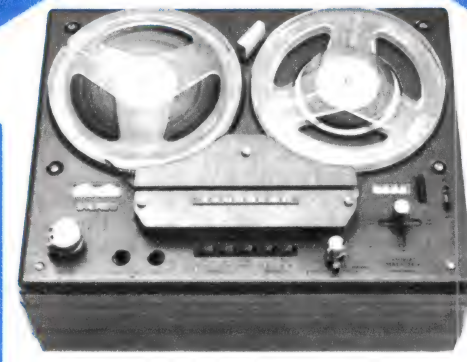
Completely solid state, the "Series 12" incorporates twin ten-watt R.M.S. stereo amplifiers, two built-in wide-range speakers, sensitivity for radio tuners and ceramic/crystal cartridges, concentric volume controls and twin electronic beam indicators for positive control of recording level. At 7½ i.p.s., frequency response is 40-20,000 Hz. Signal to noise is 55 dB. This fine recorder is the most advanced self-contained stereo recorder yet released by Tandberg and may be used with confidence as the heart of a complete high-fidelity stereo system.



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This versatile professional-quality stereo tape deck features a new bias head for guaranteed frequency response and unbeatable signal-to-noise characteristics. At 7½ i.p.s. the signal-to-noise figure is an astounding 62 dB.! Frequency response is 20-25,000 Hz. at 7½ i.p.s., a centre channel amplifier permits simultaneous playback of two tracks to mono 'phones. Monitoring is possible both "on" and "off" the tape as well as "sound on sound". Ask for complete specifications at your favourite audio store.

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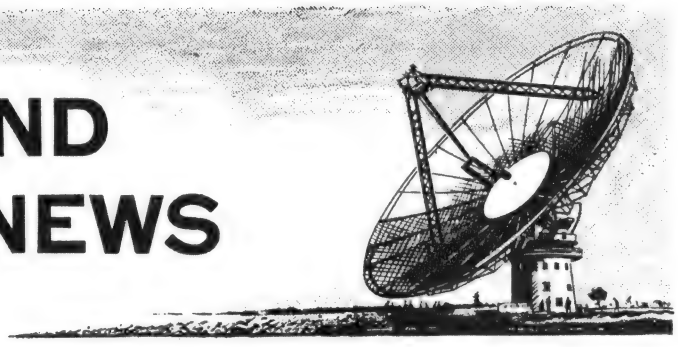
SCIENTIFIC AND INDUSTRIAL NEWS



Automatic mail reader sorter

A mail sorter that automatically reads numbers, such as POSTCODE, handwritten on letters, and then sorts them out in pre-assigned stackers at a speed of more than 5 pieces per second, has been developed for the Japanese Government's Ministry of Postal Services by the Tokyo Shibaura Electric Co., Ltd. (Toshiba). The new mail sorter is the world's first such machine capable of reading handwritten Arabic numerals without restriction at such high speed. In testing the reader-sorter's performance, it achieved 95 per cent accuracy in recognising and sorting samples of numbers written by hand with a variety of writing instruments.

The reader-sorter's optical character reading unit consists of a new type vidicon camera and a recognition logic, the latter using integrated circuits entirely in its construction. Character recognition by the machine is accomplished by an improved feature detection method recently developed for a new Multifont Optical Character Reader at the Toshiba Central Research Laboratory.

Character recognition is carried out as follows: A character is analysed by its geometrical features and compared to a dictionary of recognition logic which has been compiled from a tremendous variety of handwritten numerical characters. The dictionary is so versatile that if an unpredicted handwritten character appears, the recognition logic is improved by the addition of the handwritten number to the other characters already in the dictionary.

Toshiba has also developed the world's first facer-canceller that, in addition to facing and postmarking the mails, can sort automatically, special delivery mail from ordinary mail by recognising the colour and shape of postage stamps. Conventional machines employ expensive phosphor-processed stamps in recognition. Toshiba's new machine detects and sorts mail by the colour contrasts of the edges of the stamps and no special chemicals, designs, or printing methods are required. The Toshiba Facer-Canceller has two stamp detection sections for scanning each side of a letter. The mail is postmarked and sorted into selected stackers. Tests in the field showed a high variety of accuracy.

Light problem in space

Studies by scientists of Lockheed Missiles and Space Co. have shown why dazzling sunlight in outer space causes discomfort to astronauts. Five human test subjects needed an average of 20 per cent more time to perform simple tasks in the simulated sunlight of space than they needed in normal sunlight on earth.

Explaining Lockheed's solar illumination studies, a company spokesman, William Kincaid, said: "Our extremely bright xenon arc lamp and searchlight reflector could not match the intensity of sunlight in space, but this bright light coupled with our black, light-trapping work area helped create the brilliant glare and harsh shadows astronauts face in space work. The contrast between bright light and the deep black shadows caused by the astronaut is the major cause of the problem; it is not simply the bright light alone.

"On the earth light is dispersed by the atmosphere, reflected and scattered by every object in our environment. Almost never do we see great contrasts in light intensities, and we are accustomed to our familiar visual cues for working in an abundance of light. But in space, there is no atmosphere to disperse light. Except for reflections from the work area or the astronaut himself, the light is from a single source. Most of man's visual habits don't apply to the new condition of absolutely black shadow contrasted by brilliant light."

Linear amplifiers contract

Commonwealth Electronics Pty. Ltd. has been awarded a contract by the Department of Civil Aviation worth $202,000 for the development and manufacture of a quantity of 10KW linear amplifiers. The amplifiers will be used, in conjunction with suitable exciters, as new transmitters for the following applications:

A Volmet system from Sydney Airport which continually broadcasts weather information on a special high frequency channel. This is a particularly useful service for international aircraft as it enables pilots to receive the current Sydney weather although their aircraft could be up to 1,500 miles from Sydney.

Improved air/ground/air communications for air services between Australa, South Africa and South-East Asia.

A new air traffic control co-ordination radio telephone network linking Perth, Darwin, Djakarta, Mt. Isa, Adelaide and Alice Springs.

Additional transmitting facilities for D.C.A.'s international transmitting station at Landilo, outside Sydney.

Laser beam alignment device

A minute spot of coherent light from a laser beam is used in positioning 1½-ton jigs used as tooling in aircraft production at the Lockheed-California Company. The method is said to be as much as 12 times faster, more accurate (to five thousandths of an inch) and to require less effort because final positioning is automatic, than the previous optical systems

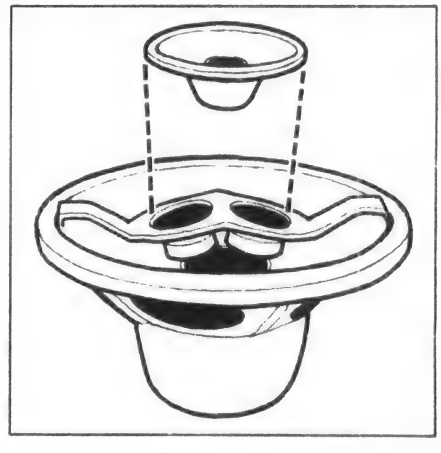
Seven high-frequency single-sideband radio transmitters have been designed and built by Amalgamated Wireless (Australasia) Ltd. for the Overseas Telecommunications Commission (Australia). They will provide high-frequency communications circuits associated with the global communications network being set up for the United States National Aeronautics and Space Administration (NASA). Five of the A.W.A. transmitters are now in use at the NASA ground station located at Wanneroo, near Perth. One of the seven transmitters is seen here under construction at the A.W.A. works at Ashfield, N.S.W.

How well can 1 speaker unit recreate the entire audio spectrum for only $60.14?

Brilliantly. You're looking at the ingenious new LORENZ 12" hi-fi loudspeaker. It's a 3-way unit, with 2 tweeters on a coaxial bracket and a high pass filter for concert-hall accuracy and clarity. Output is 30W. Frequency range: 30-15,000 Hz. Magnet is a 17½ oz. Alnico. (93,000 Maxwell). It's a true full-range speaker. It's compact. Impedence: 4, 8 and 16 ohms. Weight: 7¼ lb. The retail price is only $60.14.

Available from all recognised retail wholesalers.

For further information, contact Standard Telephones and Cables Pty. Limited, Electronic Components Division, Moorebank Avenue, Liverpool, N.S.W. 2170. Phone 60 20333, Melbourne 480 1255, Canberra 49 8667 Agencies in Brisbane 47 4311, Adelaide 51 3731, Perth 21 6461 and Launceston 31 2511



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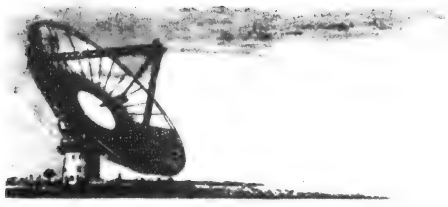


widely used in industry for this purpose. The new system is also expected to be cheaper. Although designed specifically for precision requirements of aircraft tooling and production, Lockheeds laser beam alignment has much wider application, for example, in car manufacture and heavy engineering construction. The inventor, Lockheed's Ralph A. Hamilton, also devised the earlier optical system his laser beam device will replace.

The system is unique in several aspects. It is unique in the distances over which it can be used — Lockheed is exploring its application to an 1,800-foot test range. Its automatic operation is unique — with a company-patented hydraulic positioner accurate to one-tenth of one thousandth of an inch. Accuracy of the system as a whole is unique — five times that of present systems beyond 50 feet. And so is its "modulated" signal unique — unaffected by any other light source.

Low power "Scatter" system

The Marconi Company Ltd., of U.K., has developed a new type of communications system as a substitute for short-range HF radio. Called "Thin Line Tropospheric Scatter," it is said to provide more reliable communication, and to be competitive in price, with HF equipment. The first two links using the new system have been installed for Cable and Wireless Ltd., between

The "Thin Line Tropospheric Scatter" link supplied by Marconi's for Cable and Wireless Ltd. for Cayman Brac, where signals are relayed to Jamaica and Grand Cayman, in the West Indies.

two islands in the West Indies. Eight separate telephone channels can be accommodated with this particular installation, giving high-quality communication free from much of the fading and interference which is experienced in short-wave systems.

Thin Line Tropospheric Scatter exploits a phenomenon by which radio signals, transmitted almost parallel to the earth's surface, are scattered in the lower part of the atmosphere (the troposphere), and can be received at points well over the horizon. Tropospheric scatter, as it is called, has been used in high-power, complex communication systems, but the thin line system makes it economically attractive on low-capacity routes where only a small number of telephone channels are required. Marconi's discovered that a low-cost, low-power UHF system, using medium-sized parabolic aerials, can give excellent results. For this reason the equipment is unusual and may prove to be the answer in areas of the world where there are small towns separated by up to 200 miles of difficult terrain. The second "thin line" system is already being installed to provide communications across Lake Victoria in Africa.

Remote control for substations

Thirty-five substations in N.S.W. and A.C.T. are to be remotely controlled by special supervisory control and telemetry equipment valued at $272,000. Canberra substation, which came into operation recently, is the first of the N.S.W. Electricity Commission's 330KV substations to be remotely controlled by this equipment. Designed and manufactured by Telecommunication Company of Australia Pty. Ltd., the equipment will remotely control and supervise the operation of circuit breakers, tap changers and load shedding equipment. For complete safety of personnel, the system design is based upon "fail safe" operation.

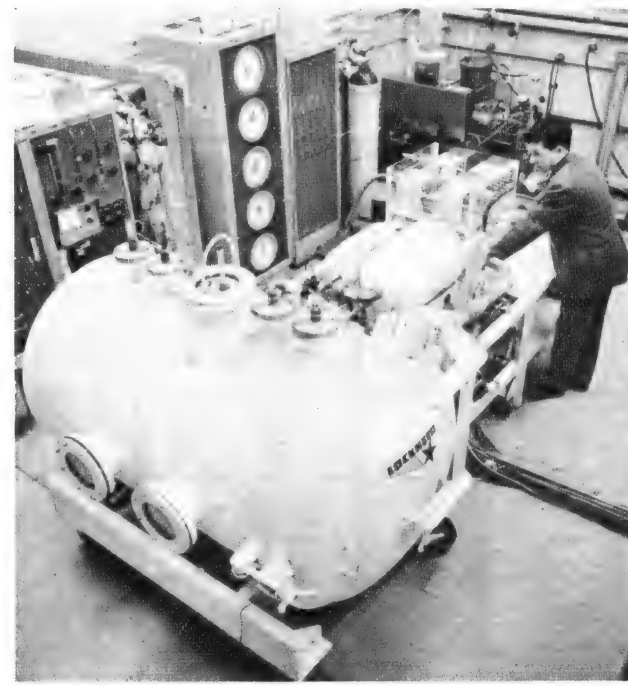
The essential elements of each basic system are a main station (master) and the substation (slave) which it controls. An operator at the master is able to remotely control a device at a slave station. In most cases, the turning of a particular type of switch — called a discrepancy key — followed by the operation of a push button, opens or closes a selected circuit breaker at the slave station. Each discrepancy key has an inbuilt light, which is turned on whenever the position of the associated circuit breaker is at variance with its position as indicated by the switch. The slave automatically sends back information about each circuit breaker's position whenever a change takes place.

The time interval between the turning of a discrepancy key and the operation of a push button is used to send a check signal from the slave to the master to ensure correct selection of the required function before the actual order can be completed. Transmission of the control information can take place over a variety of media. These include single cable pair, power line carrier, and microwave apparatus. Four signalling frequencies (540, 660, 900 and 1020Hz) are used.

Modular radar

Radar units which fit together like a giant "do-it-yourself" assembly kit are the prime feature of an entirely new series of radar equipment announced today by The Marconi Company. Almost any civil or military radar complex can be constructed from a large number of basic building blocks. These include aerials, transmitters and associated equipment, designed to make the maximum use of solid state devices, both conventional and microelectronic. Whatever the radar installation, the cost effectiveness of the scheme is said to be superior to any other currently available. The Marconi Company believes it could mean tens of millions of pounds of export business for Britain in the next few years.

This range of radar equipment incorporates 12 different types of aerial heads, five different transmitter/receivers and a complete selection of signal processing equipment built in modular



Tom Olcott, Lockheed research specialist, checks the company's two-gas regenerative life support system designed to provide four astronauts with oxygen and water on space missions lasting up to a full year. The system works in a continuous closed cycle with the small amounts of chemicals in the space cabin, reclaiming breathable oxygen from carbon dioxide and drinkable water from human body wastes. The system has successfully passed laboratory tests and is intended for manned operation later this year.

esi

300 Potentiometric voltmeter-bridge

- 0.02% voltage, resistance, current accuracy
- 0.01% ratio accuracy
- solid-state detector with 5-microvolt sensitivity
- built-in reference standard cell
- 1000-hour battery operation
- portable, rugged lightweight

Application	Function Switch Setting	Range	Accuracy	Notes
Voltmeter	V	0 to 511.10 volts in 5 ranges. 1 microvolt minimum step on lowest range.	±0.02% of reading or one switch step whichever is greater.	The 3 ranges from 0 to 5.1110 volts are potentiometric and have infinite input impedance at null. The 51.110 volt and 511.10 volt ranges have a constant 1 megohm input impedance.
Standard Voltage Source	V	0 to 5.1110 volts in 3 ranges. 1 microvolt minimum step on lowest range.	±0.02% of reading or one switch step whichever is greater.	Direct access to the internal potentiometer voltage is provided. The working voltage is a zener regulated mercury battery. The reference voltage is a transportable thermally lagged unsaturated standard cell.
Ammeter	I	0 to 5.1110 amperes in 8 ranges. 10 pico amperes minimum step.	±0.02% of reading or one switch step except on 5.1110 ampere range where accuracy is 0.06% or one switch step.	Multiplier setting "A" permits extending range by external shunts to very small or very large values of current limited only by the shunts themselves.
Kelvin Bridge	R	0 to 511.10 megohms in 10 ranges. 10 micro-ohms minimum step.	±0.02% of reading or one switch step whichever is greater except on 0.51110 ohm range where accuracy is ±0.06% or one switch step.	Four terminal connections eliminate lead and contact resistance errors. Guarding and shielding eliminate leakage resistance errors.
Comparison Bridge	R	0 to 511.10% of nominal reading of 1.0000	0.01% of reading or one switch step.	Multiplier setting "B" permits connecting external reference resistor to "External Standard" terminals.
Ratiometer	Ratio	0 to 1.00000* 0 to 0.051110 0 to 0.0051110	0.01% of reading or one switch step on all three ranges.	Maintains full five digit accuracy even at 100 to 1 ratios. *Requires reversal of test lead connections to cover range above 0.51110.

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SOLE AUSTRALIAN REPRESENTATIVES

SAMPLE ELECTRONICS

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form. In addition, the Marconi Myriad Computers can be integrated with this basic equipment together with data displays, to provide advanced data handling facilities to any system. The SECAR secondary radar system can be incorporated, the aerial fitting on to any of the surveillance radar heads.

Different combinations of the equipment can be used to form radar systems covering any of the following functions — ground control of interceptors (GCI), tactical control of weapon systems, early warning and reporting, general air surveillance, military or civil air traffic control, coast watching, etc. Civil air traffic control systems, ranging from simple, medium range air traffic surveillance to highly elaborate air traffic control by computer, can be supplied.

Solar cooker

A solar cooker, designed for sunny areas where fuel is expensive and scarce, has been developed by scientists of the Hebrew University in Jerusalem, Israel. The unit is capable of boiling nearly half a gallon of water in 20 minutes. Solar energy, concentrated by 12 concave mirrors, boils the water or cooks food without any other source of power. The mirrors are mounted in three rows on a 3ft high steel frame, and in bright sunshine, deliver about 600W of energy to the bottom of the cooker.

It is claimed that in spite of its rather elaborate appearance, it can easily be transported with the mirrors stacked and packed separately, and the frame folded. No technical skill is needed for its assembly, and it can be produced quite cheaply. Service life is estimated at 10 years or more.

Dial a computer

The first British computer service using the public telephone system is being planned by the De La Rue Bull Machines Co., which is controlled by America's General Electric. The service, to be introduced soon, will enable a large number of users to gain direct access to a computer for the price of a telephone call. General electric has set up 10 similar time-sharing services in the U.S.A.

This method of time-sharing a computer among hundreds of users has been restricted in Europe to expensive private communication lines. Since the principle behind time-sharing is to provide instant computing at a fraction the cost of conventional methods, the technique is rapidly becoming the biggest growth sector of the world computer market.

The U.K. service is expected to be designed around a General Electric 265 computer system at a cost of about $A1,250,000. For a rental of from $A500 a month, customers will be issued with a device similar to a typewriter for office, laboratory or classroom. Through this machine they will feed information to the central computer. The company expects to sell the service to small users in large companies, such as economists, engineers and scientists, who find it difficult to get occasional time on an overloaded internal computer.

Instant furniture

A new process which produces a complete chair shell in 10 minutes is being employed by Tangent Foams Ltd., of Poynton, Cheshire, England. In what has been described as the "instant furniture" technique, it involves injecting liquid resin and isocyanate into an aluminium mould. The rigid urethane shell thus formed can be removed shortly after. The material is a thermosetting plastic foam of high strength and rigidity, and is already used in Australia for many other applications. When the premixed chemicals are injected into the mould, a primary chemical reaction takes place and the foam fills the mould. A secondary reaction causes the foam to set hard; no heat is required to cure the shell. An advantage of the process is that tacking strips and fittings for legs and pedestals can be positioned in the mould, ready to become an integral part of the finished product.

Saigon telephone exchange

A new automatic telephone exchange has been opened in Saigon. The exchange is part of an integrated network that will provide a complete nation-wide telephone communications system, and the first automatic crossbar switching system in South Vietnam for civil use. The exchange, in the Saigon suburb of Tan Son Nhut, was the first of this type to be officially inaugurated.

The 2,000-line Pentaconta crossbar exchange was manufactured, supplied and installed by ITT Caribbean Manufacturing Inc. Altogether ITT Caribbean is supplying and installing approximately 8,000 lines of Pentaconta crossbar for the 23 exchanges in the system which stretches 700 miles from the delta in the south to the 17th Parallel in the north. The system is being financed by the U.S. Agency for International Development.

Translucency copier

A new type of copying machine, designed to save time for engineers and draftsmen, has been developed by the 3M Company. Called the Model 70 Translucency Copier, it is portable, and thus can be brought to the drawing board, eliminating the need to move the drawing. It makes instant stick-on drafting originals in a matter of seconds, from any source, of any size or any colour. It is operated simply by connecting the unit to any standard electrical outlet, placing it over the material to be copied, and pressing a switch. The Model 70 is a dry photo copier which uses no chemicals, toners or powders, and can be handled with the greatest of ease after a minimum of instruction.

Translucencies are available with a paper base, and with a film base which has a special adhesive backing for stick-on applications. A or B size intermediate tracings take only one minute to produce; each tracing can be used over and over again in any blueprint or dyeline making mach-

Plessey Automation is conducting data transmission trials for an Australian trading bank, and has installed a medium-speed paper tape data transmission system to link the bank's head office in Sydney with one of its suburban branches. The system is designed to allow more rapid cheque clearing and current account processing than has been available in Australia before. Illustrated are Plessey data transmission units, receivers and transmitter similar to those used for bank communications, capable of handling 600 or 1,200 bits per second over public telephone lines or private leased lines.

Developed by Standard Telephones and Cables Pty. Ltd. to provide local broadcasting facilities in isolated communities, the "Village Broadcaster" illustrated here is an economical self-contained medium wave transmitting centre. Good quality reception can be obtained over a range of at least five miles from the 130W transistorised transmitter, using a very simple aerial system. A small petrol-driven generator can provide enough power to operate the transmitter, or it can be adapted to operate from a battery source such as is available at a telephone exchange.

foster hi-fi speakers

High Compliance tweeters

FT-502

SPECIFICATIONS
Size : 50 mm (2 in.)
†Impedance : 8 or 16 Ω
Frequency Range : 2,000~20,000 c/s
Sensitivity : 100 dB
Power : 30 W max., 8 W nom.
Dimensions : 82×82 mm, 29 mm depth
Magnet Weight : 193 g (6.81 oz), Ceramic
Weight : 615 g (1⅜ lbs)

Price $8.04.
Plus Sales Tax $1.68.

High Compliance woofers

FW-162

SPECIFICATIONS
Size : 160 mm (6½ in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 40~50 c/s
Frequency Range : f_0~2,000 c/s
Sensitivity : 97 dB
Power : 30 W max., 10 W nom.
Dimensions : 166×166 mm
81.6 mm depth
Magnet Weight : 500 g (1⅛ lbs), Ceramic
Weight : 1,660 g (3⅝ lbs)

Price $12.00.
Plus Sales Tax $2.50.

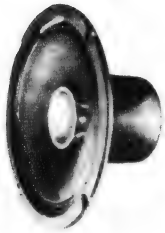
FW-202

SPECIFICATIONS
Size : 200 mm (8 in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 30~40 c/s
Frequency Range : f_0~2,000 c/s
Sensitivity : 98 dB
Power : 45 W max., 15 W nom.
Dimensions : 208×208 mm
90.8 mm depth
Magnet Weight : 830 g (1⅞ lbs), Ceramic
Weight : 2,760 g (6⅛ lbs)

Prices $23.64.
Plus Sales Tax $4.93.

Double-cone speakers

PW-65A



Size : 160 mm (6½ in.)
*Impedance : 8 Ω
Resonant Frequency (f_0) : 70~100 c/s
Frequency Range : f_0~15,000 c/s
Sensitivity : 97 dB
Power : 6 W max., 5 W nom.
Dimensions : 164.9 ϕmm, 86.2 mm depth
Magnet Weight : 77.6 g (2.73 oz)
Weight : 476 g (1⅛ lbs)

Price $6.60.
Plus Sales Tax $1.35.

*at 400 c/s; †at 3,000 c/s

High Compliance wide range speakers

FE-103

Price $8.64.
Plus Sales Tax $1.04.

Size : 100 mm (4 in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 65~95 c/s
Frequency Range : f_0~18,000 c/s
Sensitivity : 96 dB
Power : 5 W max., 3 W nom.
Dimensions : 105×105 mm, 46.6 mm depth
Magnet Weight : 193 g (6.81 oz), Ceramic
Weight : 630 g (1⅜ lbs)

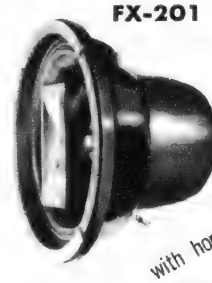
FE-163

Price $14.64.
Plus Sales Tax $3.05.

Size : 160 mm (6½ in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 40~60 c/s
Frequency Range : f_0~20,000 c/s
Sensitivity : 98 dB
Power : 10 W max., 5 W nom.
Dimensions : 166×166 mm, 73.7 mm depth
Magnet Weight : 398 g (14.04 oz), Ceramic
Weight : 1,260 g (2¾ lbs)

Coaxial speakers

FX-201

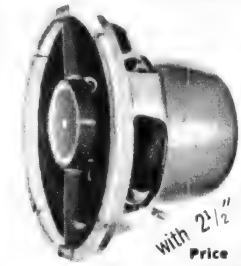


with horn tweeter

Prices $23.88.
Plus Sales Tax $4.98.

Size : 200 mm (8 in.)
*Impedance : 16 Ω
Resonant Frequency (f_0) : 45~75 c/s
Frequency Range : f_0~18,000 c/s
Sensitivity : 101 dB
Power : 10 W max., 5 W nom.
Dimensions : 206 ϕmm, 137.5 mm depth
Magnet Weight : 240 g (8.46 oz)
Weight : 2,200 g (4⅞ lbs)

FX-200 G2



with 2½" tweeter

Price $21.60.
Plus Sales Tax $4.50.

Size : 200 mm (8 in.)
*Impedance : 16 Ω
Resonant Frequency (f_0) : 45~75 c/s
Frequency Range : f_0~18,000 c/s
Sensitivity : 101 dB
Power : 10 W max., 5 W nom.
Dimensions : 206 ϕmm, 140.7 mm depth
Magnet Weight : 234 g (8.21 oz)
Weight : 2,200 g (4⅞ lbs)

2-way network

LC-100

Price $6.60.
Plus Sales Tax $1.38.

Crossover Freq.: 2,500 or 3,500 c/s
Impedance : 16 Ω
Attenuation : 6 dB/oct.
Dimensions : 63.1 ϕmm, 69 mm height
Weight : 280 g (9.88 oz)

2 or 3-way network

LC-300

Crossover Freq.: 350 or 700 c/s, 2,500 or 5,000 c/s
Impedance : 8 or 16 Ω
Attenuation : 6 dB/oct.
Dimensions : 83 H×200 W×134 mm D
Weight : 1,430 g (3⅛ lbs)

Price $22.20.
Plus Sales Tax $4.63.

tweeter

FHT-1

Price $11.04.
Plus Sales Tax $2.30.

†Impedance : 16 Ω
Frequency Range : 2,500~16,000 c/s
Sensitivity : 100 dB
Power : 10 W max., 5 W nom.
Dimensions : 110 mm height, 95 mm depth
Weight : 330 g (11.75 oz)

FHT-1

(SOLE AGENT) ZEPHYR PRODUCTS PTY. LTD.
70 BATESFORD ROAD, CHADSTONE, VICTORIA

ine. Both translucencies can be used as template material — they have a write-on surface which makes it possible to add notations with pen and pencil, and the image can also be erased with an electric eraser. Material can be copied from books or single sheet documents of any kind, it is claimed, and on-the-spot copies can be made on any flat surface in either the vertical or horizontal position.

Computerised law records

Pittsburgh University Law School Professor John Horty says that by the end of 1967 the school's computer will have the entire statutory law of the 50 U.S. States on record and be available to answer lawyers' queries. Professor Horty told a working session of the World Peace Through Law Conference that the computer had already recorded the U.S. code, all decisions by the U.S. Supreme Court since 1950, and numerous decisions by Federal Appellate Courts and State Supreme Courts. The value of the computer as a new working tool for lawyers was demonstrated by test transmissions from Pittsburgh in which computer centres supplied answers to questions in a few seconds.

Computer aids doctors

An IBM 1800 computer is helping doctors at Gentofte Hospital in Copenhagen to speed examination of patients and carry our analyses of laboratory tests. The system uses a centrally placed computer with access points from various parts of the hospital. One advantage of the system, apart from speeding results, is that doctors can spend more time with patients who really need attention, since the computer and the tests can be handled by non-medical staff.

The installation can be used both on-line and off-line. The main use at present is with heart and lung functions, particularly preceding a lung or heart operation. Ultimately, the installation will process information for patients with hearing defects and undertake analyses for the biochemical laboratory on blood and urine samples. One of the final goals is to make the machine handle the work of an intensive care unit.

Programs and patient data are stored on magnetic discs. Remotely located television screens display results from the computer, instructions to the examiners in examination rooms, and other information. A keyboard connected to each TV screen and linked to the computer allows examiners to communicate with the computer. The examiner tells the computer which patient is to be tested and what tests he is to undergo. The computer screens instructions on how to proceed with the test. The display tells when the machine is ready to accept test data and shows the computed results later.

Electronics symposium

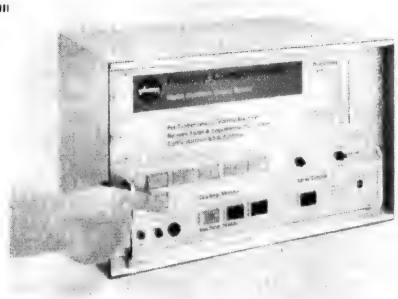
An International Exhibition and Symposium on Radio Communications and Electronic Instrumentation will be held by Racal Electronics Limited, at the Kensington Palace Hotel, London, from October 31 to November 2, 1967. A number of Australian electronics engineers and designers will attend as well as representatives of many other countries.

The Exhibition will feature communications receivers, frequency synthesisers, transmitters and linear amplifiers, remote control systems for communications, radio telephones, high frequency packsets, wideband matching transformers and data transmission systems. Registration for the symposium may be made with Racal Electronics Pty. Ltd., 75-77 Chandos Street, Crow's Nest, N.S.W.

Hungary to link with I.S.D.

Hungary's telephone system is to be linked with the European international direct dialling system (I.S.D.) at the beginning of 1968. The calls will be routed via Austria, already equipped with semi-automatic exchanges. At present all calls made from Western Europe to Hungary are manually controlled. The first step to full I.S.D. will be made when a semi-automatic exchange is installed in Budapest, the Hungarian capital. This will eventually be superseded by complete subscriber trunk dialling exchange equipment for both domestic and international calls. The equipment will be supplied probably by the Hungarian Telecommunications organisation Beloiannis. This development is expected to be able to handle 250 calls simultaneously from Europe, at an estimated cost of $5,250,000 for the project. ■

A digital control computer for the automatic stress grading of timber has been developed by Plessey Automation in Australia in conjunction with the Forestry Commission of N.S.W. The computer device has been incorporated in timber stress grading equipment known as the Computermatic Timber Grading Machine manufactured by Isles Forge and Engineering Pty. Limited of Coffs Harbour, N.S.W., who have ordered 20 of the computer units from Plessey Automation. This revolutionary development in stress grading equipment eliminates guesswork in the choice of timber for building and other construction purposes, and enables smaller dimensions of timber —as well as smaller quantities—to be used, thus cutting building costs. The original work on this equipment was done by the Division of Wood Technology, and the machine developed in conjunction with Isles Forge and Engineering Pty. Limited. Plessey



Automation was subsequently awarded a contract for its further development. The computer is now a fully digital system employing RTL (resistor transistor logic) circuitry.

Illustrated is the computer section of the Plessey Computermatic Timber Grading Machine. Each grading sequence is programmed by the insertion of a 4in x 3in card bearing a distinctive colour strip along the metal handle of the card holder.

The Playmaster 119 Stereo Tape Adapter

A basic unit for high-quality stereo recording and replay, designed to both accept and deliver 250mV "flat" signals.

By Jamieson Rowe

The unit described in this article has been designed to provide what might be regarded as the "basic minimum" electronics necessary for high-quality stereo and mono tape recording and replay, using a standard stereo or mono amplifier system and a tape deck or "transport." It does not provide microphone preamps, mixing circuitry, tone controls or power amplifiers; rather it performs the straightforward functions of accepting tonally "flat" signals at a nominal 250mV level and recording them with the appropriate equalisation, and conversely of deriving from the tape on replay similarly "flat" signals at approximately the same level.

With a suitable tape deck the adapter forms a tape unit which may be incorporated quite easily into the usual high quality stereo or mono amplifier system. When so connected it will permit the recording of any material being reproduced through the system, and conversely the replay of tapes through the system tone controls and power amplifiers.

Although the unit has been designed in the first instance for incorporation into existing amplifier systems, it may also be used for "in the field" recording independently of such a system by using it in conjunction with a suitable mixing, tone control and monitor unit. The use of such an auxiliary unit will effectively transform the adapter into a full recorder of quite respectable pretensions.

Providing, as it does, the basic requirements for high-quality tape recording and replay with the usual amplifier system, together with the nucleus of a complete stereo recorder, the adapter should make an ideal project for the enthusiast who wishes to add stereo tape facilities to his system progressively and economically. The adapter can be built as a first stage, to provide home recording facilities, with a mixing and monitor unit added later to permit operations "in the field."

If there proves to be sufficient reader interest in this approach, we may be able to describe a suitable mixing and monitor unit in a future issue of the magazine.

The new adapter employs both valves and transistors in a "hybrid" design, as this approach was found by the author to offer the best performance/cost ratio with currently available components. Valves are used in the recording amplifiers and bias-erase oscillator, while transistors are used in the replay preamps and in the level metering circuitry. The total active device complement for the unit is three valves and eight transistors, as may be seen from the main circuit diagram.

The recording channels are two-stage feedback amplifiers using a high-mu triode (½12AX7) followed by a low-mu triode (½12AU7). Negative AC feedback from output plate to input cathode is used to reduce noise and distortion, and also to provide recording frequency equalisation. Separate gain controls are provided at the input of each channel for adjustment of recording levels and control of channel balance when making stereo recordings. The gain of the recording channels is sufficient to provide an input sensitivity of approximately 250mV RMS for standard recording level with most medium-impedance recording heads.

Although the equalisation component values shown are intended to give recording equalisation substantially to CCIR standards with typical recording heads, the parameters of each type of head will tend to play a significant part in determining the effective recording characteristic. Thus ideally the component values should be tailored by the constructor to suit the particular recording heads used. Brief suggestions along these lines will be given later in the article. As most tape decks have provision for equalisation switching in

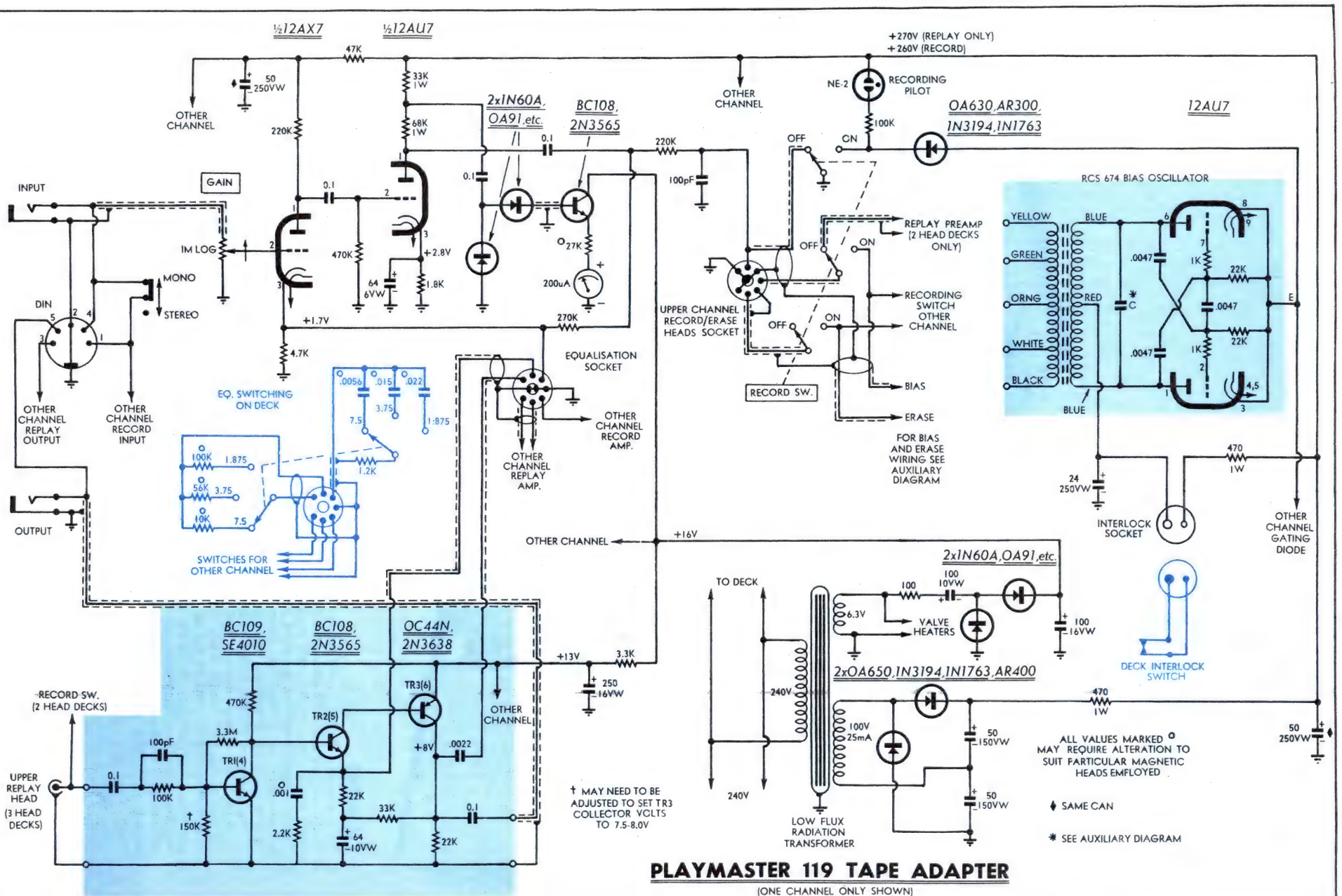
The new unit is designed to mount beside and to the right of the tape deck.

Specification

A stereo tape recording and replay adapter unit, designed for use in conjunction with a standard stereo amplifier or a suitable stereo mixing unit and power amplifier system. It accepts and delivers "flat" signals at medium impedance and at 250mV nominal impedance level. The circuitry is suitable for either two or three-head tape decks, and provides switching for independent use of both channels for mono recording. Separate edgewise-reading level meters are provided for the recording channels. The unit employs three valves and eight transistors.

Recording and replay equalisation is provided for tape speeds of 7.5ips, 3.75ips and 1.875ips, substantially to CCIR standards, so that the attainable frequency response will be primarily a function of the tape heads employed. Total record/play T.H. distortion at nominal recording level is 1 p.c., with a replay signal/noise ratio of approximately 44dB.

The diagram on the opposite page shows the full circuit of the new adapter.



PLAYMASTER 119 TAPE ADAPTER

(ONE CHANNEL ONLY SHOWN)

Grundig world-range radios

TR5000

The Grundig name has become a legend for quality in radio sound. And with radios like the extraordinary Grundig Sattelit, it's no wonder! You can be an eavesdropper on the world. Two Superphon dynamic loudspeakers give you world-wide reception on thirteen wavebands—with an unbelievable depth and clarity of sound. Short wave, FM, bandspread, too! The Satellit TR5000 is designed to operate on batteries or AC mains, and receives VHF/FM, long, medium and short wavebands. The short wave coverage ranges from 10 to 187 m., split into four bands.

Additionally, six bandspread short wave ranges are provided, shown on a separate scale with a rotating drum selector. The Satellit is fitted with 17 transistors and 11 diodes. It features a short wave fine tuning dial, automatic frequency control on FM, R.F. stage, a switchable ferrite aerial, a double extension telescopic aerial, a separate control for the bandspread short wave tuner, duplex drive on FM/AM, a tuning and battery indicator, and two multi-octave loudspeakers. The Satellit also has an illuminated tuning scale and separate bass and treble controls. Sockets are provided for headphones, external aerial and earth, car aerial, record player, tape recorder and external battery power supply.
The Satellit transistor 5000 has a handsome padded graphite case with chrome and satin silver trim. It measures 16" x 10" x 4¾".

TR3000

The Ocean Boy TR3000 is not just a transistor radio, it is a perfect piece of precision engineering. The whole world's your oyster with the Grundig TR3000. Choose a wavelength by pressing one of the nine buttons and using the fine tuning control. See visually when you are at the point of best reception by the tuning indicator (which doubles as battery indicator). Adjust the bass and treble tone controls and you're hearing a radio that's built for listening to, not straining at. The Ocean Boy has two loudspeakers, 13 transistors, 8 diodes and 2 rectifiers. Provides matchless listening on VHF/FM, long, medium and 4 short wavebands (10 to 185 m.). Output is up to 2 watts (R.M.S.).

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GEP344R

GRUNDIG . . . the world's largest manufacturer of tape recorders . . . stereograms . . . and dictating machines.

tandem with the actual speed adjustment, the adapter has been designed so that the equalisation components and switching are "outboard" — connecting into circuit via a standard miniature 7-pin plug and socket.

Recording level monitoring is performed by metering circuits which derive signals from tappings on the output stage plate loads. The metering circuits employ voltage-doubling rectifiers followed by transistor emitter follower stages giving current amplification and impedance matching. The meters used are small edgewise-reading units of Japanese manufacture, having an F.S.D. of 200uA. They have light damping, and in this circuit give an indication which closely follows the peak signal envelope. (Type V303 level meters as pictured are available from trade houses, or direct from Electronic Supplies, Box 417, P.O., Crown Street, N.S.W. 2010.)

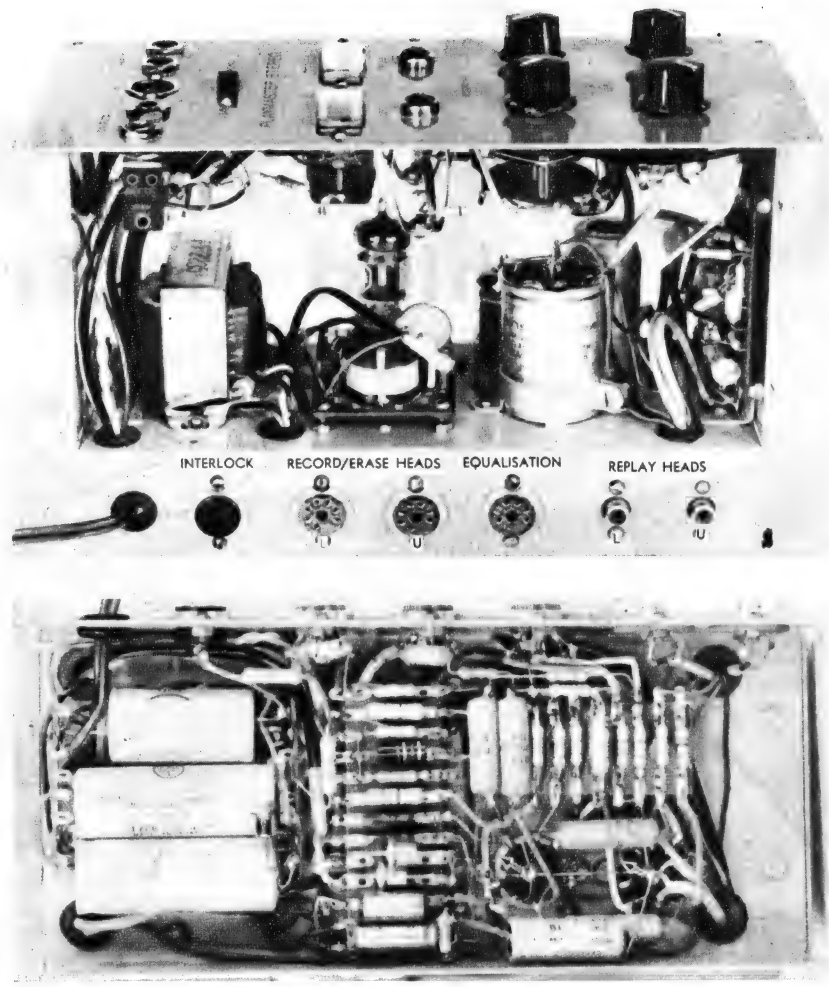
Audio feed to the recording heads is via conventional "current drive" resistors (220K), while bias injection is of the "series" configuration for minimum bias level at the plates of the recording output stages. Each channel has a recording "on-off" switch and a neon warning lamp, while accidental erasure is prevented by a deck interlock switch operating in series with each channel recording switch as far as the bias/erase oscillator is concerned. For the oscillator to be activated, at least one of the recording switches must be turned "on" in addition to the closure of the deck interlock switch. Both switches and silicon diodes are used to perform the "AND" logic function involved in this interlocking.

The bias/erase oscillator is an RCS type 674 printed wiring board unit, as designed for our Playmaster 110 tape system. It uses a 12AU7 valve in a push-pull Hartley circuit, operating at 50-100KHz to suit the particular heads in use. The secondary winding of the oscillator transformer has taps which permit matching with most recording and erase heads likely to be encountered. The complete bias oscillator is assembled on a small printed wiring board which is bolted to the main adaptor chassis.

Connections for the recording and erase heads of each channel are made via miniature 7-pin plugs and sockets. A two-pin plug and socket are used for connection to the deck interlock switch. The replay heads are connected to the unit via individual shielded leads and small co-axial connectors.

The replay preamps are based upon a design described by the author in the October 1965 issue of the magazine. Each channel employs three transistors, two type NPN and one PNP. The two preamps are assembled on a small printed wiring board which bolts to the main adapter chassis in similar fashion to the bias/erase oscillator.

As with the recording amplifiers, replay preamp equalisation is modified for the various tape speeds via "outboard" switching on the tape deck. The replay preamps connect to the deck switching via the same 7-pin plug and socket used for recording equalisation inter-connection. The replay equalisation component values shown are again typical values only, and should ideally be tailored to suit the heads in use, if optimum results are to be achieved; however, the values shown should give approximately CCIR replay equalisation with a majority of medium-impedance heads of recent manufacture. Brief information will be given later in the article to serve as a guide to constructors in modifying the component values.



Two views of the new adapter, one taken from the tape deck side and the other from beneath. The components mounted on the resistor panel in the centre of the lower view are as follows (top to bottom): 220K,68K 1W,33K,47K 1W,33K,68K 1W, OA91,OA91, 2 x power diodes (oscillator gating), 100uF 16VW,100uF 25VW. Those on the smaller panel at upper right are (left to right); 2 x 0.1uF (rec. output), 1.5K/64uF,2 x 470K,1.5K/64uF,2 x 4.7K, 2 x 220K. Arrows show the gap orientation of the valve sockets.

An idea of the potential of the adapter circuitry may be gained from the fact that the prototype adapter was tested with a Collaro "Studio" tape deck having relatively modest Reuter heads. With the equalisation component values shown in the circuit, these heads provided a 7.5ips CCIR replay characteristic flat within plus and minus 3dB from 60Hz-16KHz, and an overall record-play characteristic of 60Hz-13.5KHz within the same limits.

The adapter may be used with either three-head or two-head tape decks, a three-head being preferable for high-quality recording as it permits "off the tape" monitoring during the actual recording process. With three-head decks the replay preamp inputs connect permanently to the replay head windings, as shown, whereas for two-head decks the inputs connect to the recording switches and thence to the R/P heads in the "off" positions. Note that with most two-head decks it will not be possible to replay in one of the channels whilst recording in the other, this being prevented by excessive bias induction from one head winding to the other.

Two parallel-connected arrangements are provided on the adapter for signal input and output. A 5-pin continental "DIN" socket wired in the standard fashion permits convenient single-cable interconnection with amplifiers and other equipment provided with similar connectors, while two pairs of standard telephone jacks permit interconnection with other equipment.

A switch marked "stereo-mono" is connected to the recording channel inputs so that it can parallel the inputs when required for mono recording through either channel.

The power supply of the adapter employs two voltage-doubler rectifier circuits fed from a small low-leakage power transformer. A full-wave doubler circuit is used to provide approximately +260V DC for the valve circuitry, while a half-wave doubler circuit connected to the 6.3V heater winding produces approximately +16V for the

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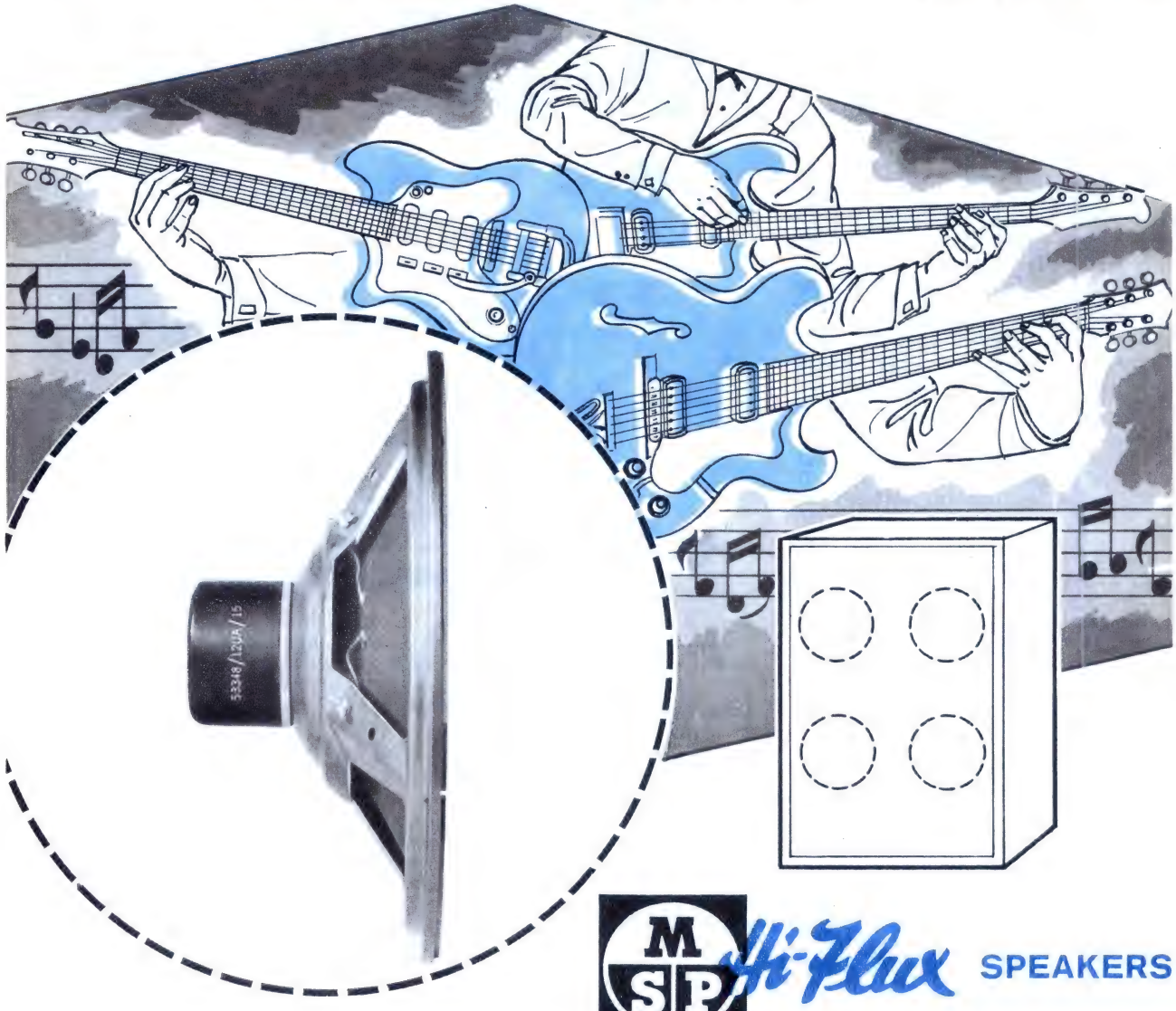

M.S.P. Hi-Flux SPEAKERS

SPECIFICATION

TYPE No. 53348/12UA/15	
Max. Power Handling	15W
Frequency Range	45-6000 Hzs
Resonance	50 Hz
Magnet Material	Alnico V.
Flux Density	13,000 guass
Total Flux	100,000 lines
V. C. Diameter	1¾"
Impedence	15 ohms
Mounting Hole Centres	11¾" P.C.D.
Maximum Depth	4¾"

A new speaker design which matches perfectly to the full sound colour of the guitar and yet can handle large amplifier power outputs with great ease.

Sounds plucked from a guitar string have very special characteristics that have challenged the speaker designers capability for many years — M.S.P. now has what the world's best guitarists have been waiting for.

Four completely new 12" Hi-Flux speakers in an enclosure specially designed for large power handling. This new M.S.P. combination is rated at 60 watts and outperforms all other units tested including some very elaborate, expensive models.

Write for the name and address of your nearest demonstration centre or for details of the M.S.P. home constructor's kit.

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transistor circuits. R-C filtering is used in both supplies. The power transformer used in the prototype was designed especially for this project by Ferguson Transformers Pty. Ltd., and has a copper shorting band for reduced leakage flux. It is coded type PF2235T, and may be ordered via the usual suppliers; similar transformers may be available from other manufacturers in due course.

It may be noted that the main circuit diagram of the adapter does not show the bias and erase connections to the secondary of the oscillator transformer. The reason for this is that the matching arrangements required will vary with the type of heads to be used. As there are quite a number of tape decks and magnetic heads available to constructors, it would not be feasible to provide in this article connection details for all possible decks and heads. Details of the connections which should be suitable for the more commonly available decks and heads are shown in the auxiliary circuit diagram. It should be stressed, however, that the wiring arrangements shown are based largely upon manufacturers' published data, and should therefore be regarded as "suggested starting points" rather than definite prescriptions.

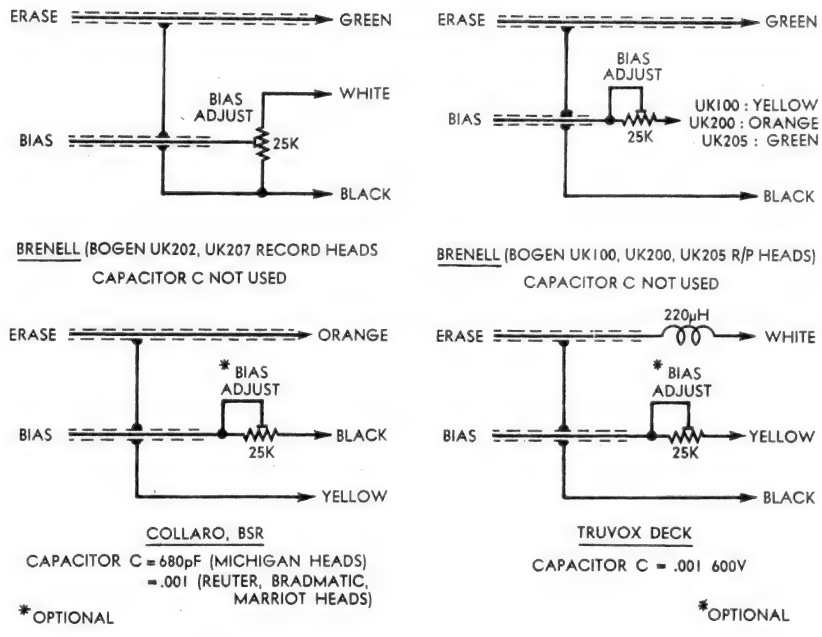
Physically the new adapter takes the form of a small chassis suspended from a control panel, the latter intended to mount alongside and to the right of the tape deck on the cabinet motor-board or plinth. The control panel measures 5in x 10in, and the total suspended depth of the unit below the panel mounting surface is 6in.

As may be seen from the photographs, the control panel mounts the input-output connectors, the stereo-mono slide switch, the level meters and recording pilots, the recording switches and the recording gain controls. The power transformer, bias oscillator, recording channel valves and HT filter electro mount on the top of the chassis, with the replay preamp bolted to the end plate furthest from the power transformer. The majority of the minor components are mounted on miniature resistor panels underneath the chassis, with the deck cable connectors mounted along the side nearest the deck.

It may be noted that a small metal shield is fitted between the replay preamp board and the record channel switches. The purpose of the shield is to reduce bias injection into the replay preamps during recording. Without the shield, injection of bias into the preamps tends to cause distortion during "off the tape" monitoring of a recording.

Wiring the adapter should be fairly straightforward if the circuit diagram and photographs are used as a guide. Included in the article is a diagram showing placement of components on the replay preamp board, while the underchassis photograph is provided with a caption giving the values of most of the minor components.

There are a number of general rules which should be observed if the adapter is to function correctly when completed. The first of these is that particular care should be taken to ensure that there are no earthing loops in the signal circuitry of either the recording or replay channels. Such loops can cause both hum and instability in this type of equipment, and should therefore be studiously avoided. Similarly care should be taken



Suggested connecting arrangements for the heads used on some common tape decks, compiled from manufacturers' data.

to prevent bias/erase currents from flowing through signal cable earthing braids.

In general the earthing arrangements shown on the circuit diagram are those which will produce correct operation. Note that the replay heads must not be earthed at the deck itself, but are ultimately earthed via the replay preamps at the adapter output connectors; both the head connectors and the replay preamp are insulated from the adapter chassis. It should also be noted that the shield braids of the replay preamp equalisation cables are connected to earth only at the deck interconnection socket, and that the erase head earthing is carried out solely at the record switches, with the erase cable braids being insulated from the record head braids.

It cannot be emphasised too strongly that with tape equipment proper earthing is essential for satisfactory operation. Another important point to watch is that the tape deck metalwork should be bonded to the adapter chassis through a lead or braid having as low an impedance as possible. Neither the deck nor the adapter chassis need connect to the mains earth other than via the equipment to which the adapter is connected (in fact an additional earth may well cause trouble due to the earth loop created) but they should always be firmly bonded to one another.

When the adapter has been completed, a number of adjustments may be required for optimum performance with the tape heads being used. Brief details of these adjustments will now be given.

Probably the adjustment to be made is that of head azimuth. Here the idea is to standardise the magnetic heads of the deck used, so that they are capable of producing and replaying tapes which are compatible with other machines. In the case of three-head decks there is the equally important requirement that the replay and recording heads have identical azimuth, to ensure that the system

Parts List

1 Chassis and front panel, 10in x 5in x 6in.
1 Power transformer, secondaries 100V at 25mA and 6.3V. at 1A, with copper shorting strap for reduced flux leakage.
1 RCS type 674 supersonic bias/erase oscillator.
1 Printed wiring board, type 65/p10.
2 3-pole 3-position rotary switches.
1 SPDT slider switch.
2 Edgewise-reading level meters, 200uA FSD, type V303 or similar.
2 Neon lamps and bezels.
4 Telephone jacks, open-circuit type.
1 5-pin "DIN" socket.
3 7-pin miniature plugs and sockets.
1 Polarised 2-pin plug and socket, miniature.
2 Co-axial audio plugs and sockets.

VALVES

2 12AU7A. 1 12AX7.

TRANSISTORS AND DIODES

6 1N60A, OA91, etc.
2 OA630, AR300, 1N3194, 1N1763, etc.
2 OA650, AR400, 1N3194, 1N1763, etc.
2 BC109, SE4010, etc.
2 BC108, 2N3565, etc.
2 OC44N, 2N3638(A), etc.

CAPACITORS

LV plastic type: 2 x 100pF, 2 x .001uF, 2 x .022uF, 2 x .0056uF, 2 x .015uF, 2 x .022uF, 4 x 0.1uF.
400V plastic type: 2 x 100pF, 6 x 0.1uF.
Electrolytics: 1 x 25uF 250VW, 2 x 50uF 150VW, 1 x 50-50uF at 250VW (dual chassis mounting type), 2 x 64uF 6VW, 2 x 65uF 10VW, 1 x 100uF 10VW, 1 x 100uF 16VW, 1 x 250uF 16VW.

RESISTORS

Half-watt 5 p.c.; 1 x 100 ohms, 2 x 1.8K, 2 x 2.2K, 1 x 3.3K, 2 x 4.7K, 2 x 10K, 4 x 22K, 2 x 27K, 4 x 33K, 2 x 56K, 6 x 100K, 2 x 150K, 4 x 220K, 2 x 270K, 4 x 470K, 2 x 3.3M.
1W 10 p.c.: 2 x 470 ohms, 1 x 47K, 2 x 68K.
Potentiometers: 2 x 1M log, bias pots 25K if used.

MISCELLANEOUS

2 x 9-pin valve sockets, 1 x 13-tag and 1 x 10-tag lengths of minature resistor panel, 2 x 8-tag miniature tagstrips, 4 x small knobs, 6 x 3/8in grommets, scrap aluminium or steel sheet for preamp board shield, connecting wire, insulating sleeving, shielded cable, nuts, bolts, spring washers, solder, etc.

can replay its own recordings with optimum performance. Adjustment of erase head azimuth is not necessary, and in any case is normally not possible.

The record/play head of a two-head deck and the replay head of a three-head deck are adjusted for correct azimuth using a pre-recorded test tape or music tape. As the head azimuth is adjusted, it will be found that the treble response will peak at one setting; this is the correct azimuth setting. Ideally the adjustment should be made using an audio millivoltmeter and a test tape recorded with either white noise or a high frequency tone (often 10KHz). However a satisfactory adjustment may be performed using a pre-recorded music tape and aural monitoring of the replay signal.

Once the replay head of a three-head deck is adjusted for correct azimuth, it must be used to set the recording head to correspond. As might be expected this involves the recording of a test signal and adjustment of the recording head azimuth for optimum treble response. Although the adjustment can be performed satisfactorily by ear, it is again preferable to use a millivoltmeter and either a white noise generator or a source of 10KHz sine wave tone.

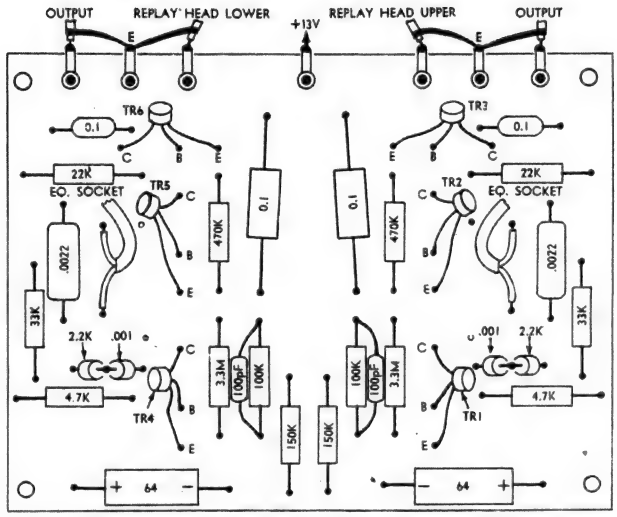
The next possible adjustment is that of optimising recording bias level, a procedure which while not essential is particularly worthwhile with recording heads of better-than-average quality. With bias adjusted to the optimum level, the recordings made will have the best compromise between distortion, signal-to-noise ratio and frequency response. Less bias will in general result in improved frequency response but increased distortion and noise, while more bias will give reduced distortion and noise but a degradation in frequency response.

The general procedure in adjusting bias is to record a test tone of 1KHz (alternatively a musical signal predominantly composed of middle frequencies), while slowly increasing bias from minimum. The signal replayed from the tape will be seen to increase with bias at first, then peak and thereafter fall away. The optimum bias level is that where the replay level has peaked and fallen to about 0.8 of its peak value.

It is naturally somewhat easier to adjust bias with a three-head deck, as replay can be performed during recording. With a two-head deck the best procedure is probably to record and replay a short test section after making small increments in the bias adjustment.

Adjustment of the replay equalisation component values may be necessary to obtain optimum replay frequency response with the tape heads concerned. In general, if on a given speed setting there appears to be insufficient bass relative to mid-and high-frequencies, the value of the switched resistor should be reduced and vice-versa. If the high frequencies seem on all speed settings to be unduly prominent, the value of the capacitor bypassing the emitter of T2 should be reduced from its stated value of .001uF. Conversely this capacitor should be increased in value if the high frequencies seem unduly weak. Note that the 2.2K resistor in series with this capacitor **must not** be reduced in value or omitted, as this can produce instability and/or excessive bias pickup during recording.

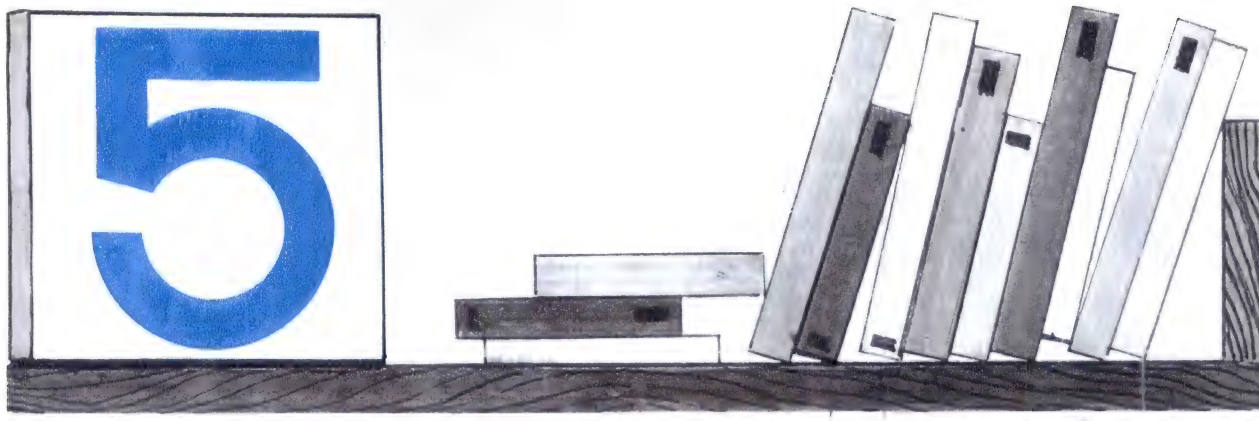
Replay equalisation is best performed while replaying a pre-recorded tape, as this isolates the equalisation concerned. Once the replay equalisation is set this may then be used to optimise the recording level and equalisation.



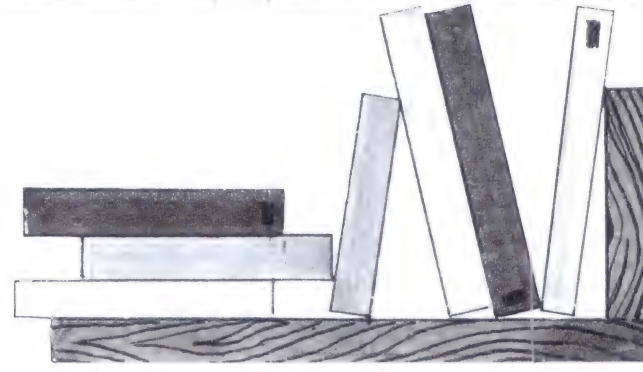
A sketch showing the position of the components which mount on the replay preamp wiring board.

Adjustment of recording level is performed by variation of the level meter series resistors. The resistors should be set at a value which produces full-scale deflection at a recording level which is just short of producing audible distortion of the replayed signal. The easiest way to make the adjustment is to connect a potentiometer temporarily in series with a meter, and monitor the recording of a 1KHz test tone (with two-head decks this will involve recording, rewind and replay each time an adjustment is made). Once the correct setting is found, the potentiometer can be removed and measured and appropriate fixed resistors wired in series with the meters.

The final adjustment to be made is that of recording equalisation, which is determined on each speed setting by the value of the switched capacitors. The procedure is again that of recording and replaying a test frequency run or musical signal, monitoring the recording either aurally or with a millivoltmeter. If the high frequencies are unduly peaked, the value of the appropriate capacitor should be reduced. Conversely if the high frequency response is poor, some improvement may be achieved by increasing the capacitor value. ■



5 REASONS WHY . . .



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10D7M	1800′ 1.0 Mil Polyester	7.70	3.85
5D7M	2400′ .5 Mil Polyester	9.30	4.65
5D7MT	2400′ .5 Mil Tensil. Poly.	10.50	5.25
5D7MS	3600′ .48 Mil Polyester	15.90	7.95
5D7MTS	3600′ .48 Mil Tensil. Poly.	17.90	8.95
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15D5	600′ 1.5 Mil Acetate	$3.60	$1.80
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10D5M	900′ 1.0 Mil Polyester	5.32	2.66
5D5M	1200′ .5 Mil Polyester	5.70	2.85
5D5MTS	1800′ .48 Mil Tensil. Poly.	9.96	4.98

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FIXED RESISTORS

Types of resistors — Their characteristics — Temperature effects — Storage and service problems — Voltage coefficient — Inductance and capacitance — Special types.

By P. S. Redfearn

It is fairly safe to say that the most common component to be found in electronic and electrical equipments is the fixed resistor; although a simple device there are, nevertheless, many years of applied science and manufacturing know-how behind the components in use today. A selection of resistors from various manufacturers throughout the world would appear to be a motley collection — different sizes, shapes, finishes and terminations — and yet they would be found to comprise mainly four basic types.

For any particular application there is the "right" component and the following description of resistor characteristics, together with an outline of production processes, should assist the constructor to make the correct choice for his own projects.

Types of resistors: The four basic types in general use are: (1) moulded carbon composition, (2) carbon film, (3) pyrolytic or cracked-carbon (also known as deposited carbon) and (4) wire-wound.

The **moulded carbon** resistor is produced from carbon, a refractory filler, such as talc, and a resin binder which are ground and mixed in powder form, then die-pressed into the shape of a rod and cured in a kiln. By varying the proportion of carbon and filler, the resistance of a batch of rods can be controlled within certain limits but sorting into different values is always necessary and is done automatically by machines using the limit-bridge measuring method. Depending on the manufacturer's own technique, connecting wires may be moulded into the ends of a rod during the die-press process or, after curing, the rod may be metallised at each end and the wires wrapped and soldered or, as a further alternative, attached by means of force-fit pressed-metal caps. After this, the resistor may be given simply a coat of paint (in colours indicating its value) or it may be better protected and insulated by enclosure in a ceramic or plastic tube or thermosetting plastic mould.

The **carbon film** resistor is another composition type but manufactured differently from its moulded counterpart. A continuous extrusion of glass tubing of about 1/16in outside diameter is drawn through a liquid carbon mix to leave a uniform film on the tubing, which is then heated to fix and cure the material. The tubing is cut to the required predetermined lengths and connecting wires, crimped a little way from one end to form a plug, are inserted in each end of a tube and secured with a conducting cement that makes contact with the resistive material. Each wire extends well inside the tube in order to better collect and dissipate the heat generated in the resistor when in use. Protection is usually afforded by a thermosetting plastic case, having a diameter four or five times that of the glass tube to ensure rigidity and also to function as a heat sink. Finally, the resistors go through the same sorting procedure as the moulded variety.

The resistive element for the **cracked carbon** type of resistor is produced by the pyrolytic process known as "cracking"; ceramic rods of controlled dimensions are heated to about 1,000 deg. C. and exposed to a hydro-carbon gas (usually methan), which decomposes to leave a carbon deposit on the rods. The resistance of the deposit can be predetermined with reasonable accuracy by selection of the rod temperature, gas pressure and exposure time. Next, a helical groove is cut through the carbon and into the rod thus, in effect, providing a very thin ribbon of material wound along the length of the rod. The cutting process is fairly precise and is accomplished by means of au automatic lathe-like machine fitted with a diamond-cutting wheel; the width and pitch of the cut can be set up to determine the final resistance within 2 per cent and 5 per cent, but, for consistently greater accuracy, the machine may require to be manually operated. Connecting wires are attached to metal caps force-fitted over the ends of the rod and protection is provided by a coating of silicone lacquer or enclosure in a ceramic or plastic tube. The resistors are sorted into tolerance groups of 5 per cent, 2 per cent and 1 per cent.

Wire-wound resistors, the last of the four types considered, consist of a rod or tube of ceramic, glass or glass fibre on which is wound a single layer of resistance wire, nickel-chromium and nickel-copper being the most commonly used. The production process is almost wholly automatic, employing what are virtually coil-winding machines. The ends of a winding are connected to clips or wires by brazing or riveting and, while some components are left unprotected, it is usual to "finish" with a coating of cement, vitreous enamel or lacquer. Production tolerances are within 5 per cent and, by subsequent selection, within 1 per cent of nominal values.

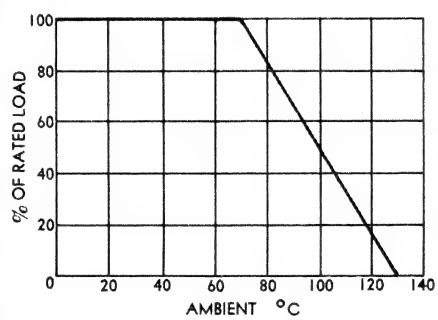

Figure 1: A typical de-rating curve illustrating how dissipation limits for carbon resistors must be lowered, where increased ambient temperature is anticipated.

Characteristics: The power that a particular type of resistor can dissipate is dependent on the permissible rise in working temperature which, in turn, is a function of the ambient temperature and the resistor's form of construction. Consequently, without reference to the ambient temperature, it is impossible to specify precisely the wattage rating of a resistor. It is usual, however, for manufacturers to specify a nominal rating at a given ambient temperature (commonly 40 deg. C or 70 deg. C) and in their catalogues to publish derating curves which indicate to what extent the dissipation must be reduced at elevated temperatures. A typical derating curve for carbon film resistors, based on 70 deg. C, is shown.

The **maximum surface temperature** at which resistors may be operated is about 100 deg. C for composition, 150 deg. C for cracked-carbon and 400 deg. C for some wire-wound types. This is not to say that they should be run at such high temperatures, particularly if long life, stability and minimum noise are important factors!

Resistors are subject also to a **maximum voltage** rating beyond which corona discharge or a complete breakdown can occur; this voltage varies between 50V and many kilovolts, depending on the resistor type and its physical dimensions.

The wattage rating is usually the limiting factor for low-resistance values but the voltage rating becomes the limiting factor for high values. Consider a 1M resistor rated at 250mW (at 70 deg. C ambient) and 250VDC continuous. At the maximum voltage, only 62.5mW is dissipated and cannot be increased without exceeding the continuous voltage rating. On the other hand, a 100K resistor of the same type and wattage rating would dissipate 625mW, more than twice the permissible rating at maximum voltage; obviously, in this case, it is not possible to apply 250V continuously if rapid disintegration of the component is to be avoided.

Resistors **stored** under normal conditions are subject to a spontaneous aging and a consequent change of value, which can be either temporary or permanent. The change may be as much as 5% for composition types and about 1% for cracked-carbon and wire-wound types, and may be sufficient to compromise the performance of critical circuits. Some manufacturers endeavour to overcome this difficulty by pre-curing, i.e., artificially aging their components prior to sorting.

In service, as distinct from storage, high ambient temperature, power dissipation and soldering are contributory factors which can cause permanent changes of value to components. A 20% change is not uncommon for composition resistors but the average figure

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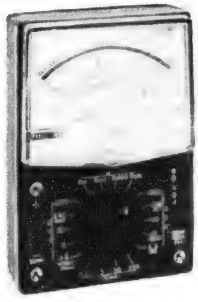

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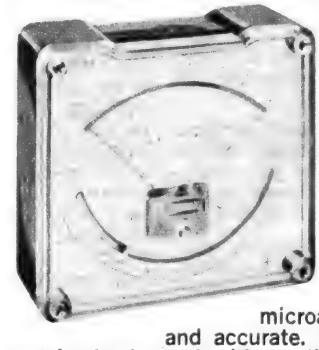
DC current: 50μa, 0.5ma, 5ma, 50ma, 250ma
Resistance: From 50 ohms to 50k ohms in four ranges
Volume level: — 20~ + 62db



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DC current: 40μa, 0.5ma, 5ma, 50ma, 500ma
Resistance: From 100 ohms to 250k ohms Midscale in four ranges. **Load current: LI** — 15ma, 1.5ma, 150μa
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Forum

The FET Preamp. for magnetic pickups

As a change from radioactivity in valves and such devices, we turn to one of the more recent solid-state devices — the field effect transistor. A correspondent from East Brighton, Vic., doesn't like our recent FET preamplifier, and says so. To answer his criticism is Technical Editor, Jamieson Rowe.

Conducted by the Editor

The preamplifier in question was featured as part of the Playmaster 115 solid-state stereo amplifier. Our correspondent has this to say:

The Technical Editor,
Electronics Australia.

Dear Sir,

"As an Electronics Engineer I read your journal with interest and appreciate your efforts to educate the public in the possibilities of new developments in electronics. However, it is important that new devices should be used only where they offer a clear technical and/or economic advantage, and circuits using them should be well designed, so that they do not create a bad initial impression. Consequently I was very disappointed to read the article describing a preamplifier for magnetic pickups using FETs as it met neither requirement.

"While the availability of FETs such as the 2N4360 at a relatively low price raises a number of exciting possibilities, these do not include suitability for use in preamplifiers for magnetic pickups.

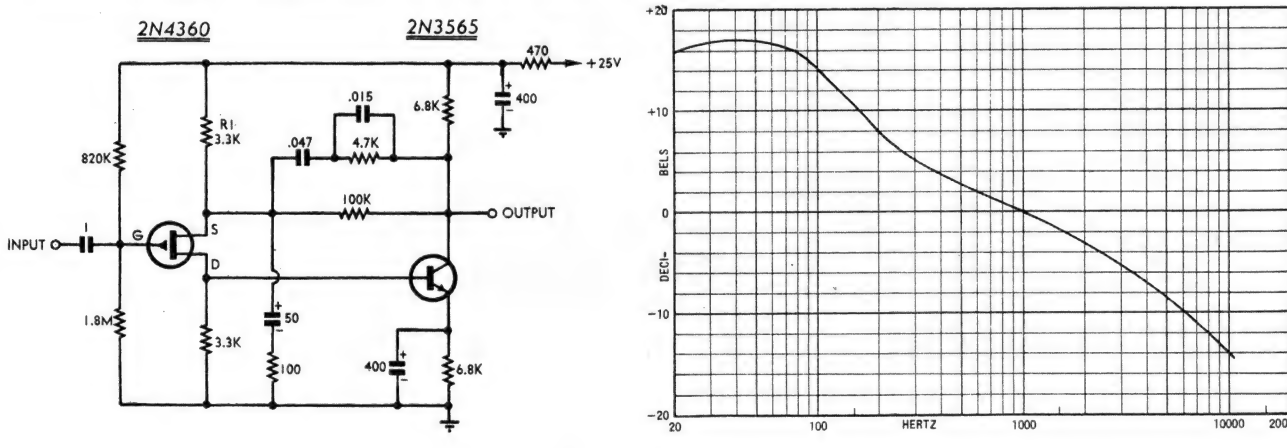
"The comments in the article on the input impedances of the usual bipolar transistor have little relevance, since exceedingly high input impedances can readily be achieved using transistors such as the 2N4250.

"There would have been some point in using FETs in the input stage of the main amplifier, as the main source of noise with a ceramic pickup is the current noise of the input transistor flowing in the very high low-frequency source impedance, and the much lower noise current of the FET would have permitted an improvement in the already adequate signal to noise ratio.

"However, with a magnetic pickup, a very high gain is required at low frequencies and, as the output impedance at these frequencies is low, the main source of noise is the low-frequency voltage noise of the transistor. Presently available FETs have a large low-frequency noise component and exhibit a much higher low-frequency noise voltage than normal transistors. They also have a relatively very low ratio of Gm to Id and an extremely wide spread of characteristics, making it very difficult to match them to normal transistors. Thus the stage gains attainable are normally low, and an FET circuit will invariably be more complex, more expensive, and have a worse performance than the equivalent circuit using normal transistors.

"I was therefore sceptical when I saw your circuit, the more when analysis indicated that the overall gain was unlikely to be more than 300 without feedback. To confirm my suspicions I assembled the circuit only to find that it oscillated uncontrollably at about 100Hz, probably because of feedback through the decoupling resistor and an unfortunate choice of bypass components. After increasing the standing current from 2.0 to 2.5mA, the oscillation died away but a strong peak remained at 100Hz, below which the gain fell rapidly. The 2N4360 used had Id=3.5mA, Gm2.0 at Vgs=0, typical of 90 per cent of those received so far. I can only presume that you used a markedly different transistor and/or that tolerances on electrolytics pushed the resonant peak to a lower frequency.

"Thus there is no technical justification for using an FET in this circuit and, by so doing, the signal-to-noise ratio, already barely adequate, is



The FET preamplifier circuit suggested by our correspondent and its frequency response curve.

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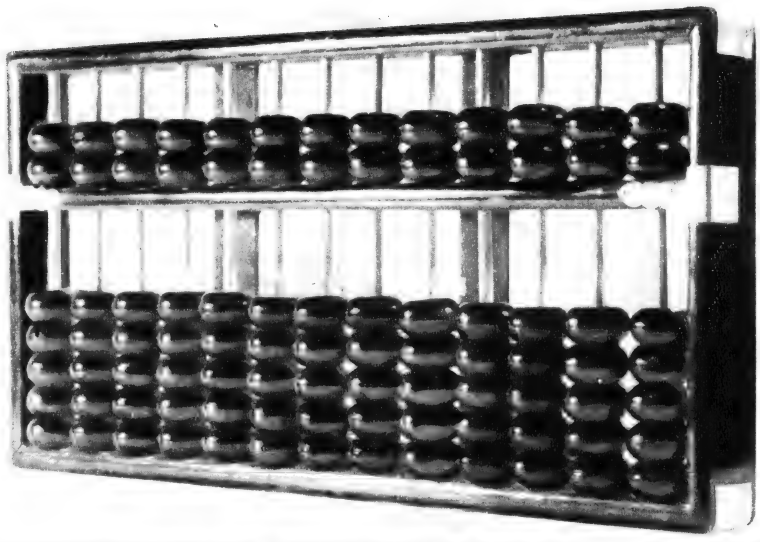

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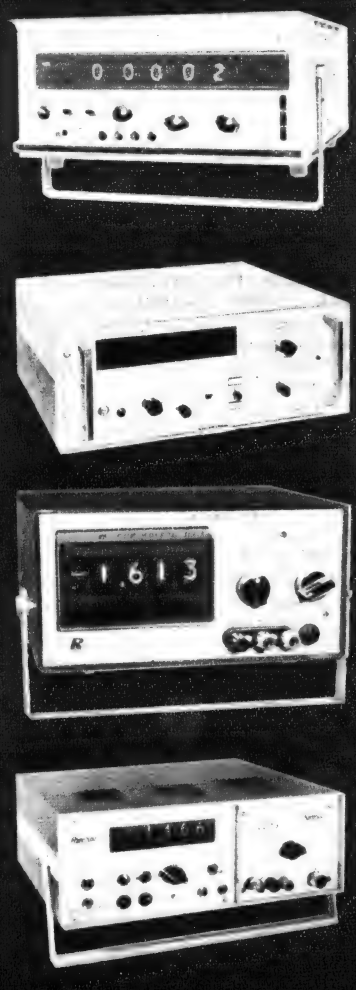

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further reduced and the complexity and price needlessly increased. Worse, the circuit will generally not meet the specifications and appears likely to exhibit a strong tendency to low-frequency oscillation.

"If FETs must be used, the accompanying circuit will give about as good performance as can be obtained with two transistors. This has an open-loop gain of about 800 and its performance is as shown. The equivalent input noise voltage is about 10uV, referred to 1000Hz. This will work for most 2N4360s but, if the zero bias current is above about 5mA, R1 may have to be increased to give 5-8V across the transistors.

"By contrast, a typical circuit using normal transistors, has an open-loop gain of about 5000, giving much lower distortion and sensitivity to temperature and other effects, draws 1mA as against 4mA, and has about 30dB better signal/noise ratio. The input impedance is 550Kohm and the equivalent noise voltage, referred to 1000Hz, is about 0.2uV."

R.R. (East Brighton, Vic.).

Perhaps we should explain that what is reproduced above is actually a precis of the original letter but it does contain all the essential material. Similarly, what follows is a precis of what Mr Rowe drafted as a complete reply to the original letter, and which was posted direct to the correspondent. However, it indicates the main lines of the rebuttal.

Mr Rowe Replies:

"In answering the above criticisms I feel that I must first mention that we find ourselves in agreement with many of the theoretical points raised by our correspondent concerning the problems of using the new FET devices in general and the 2N4360 device in particular. We were, in fact, aware of most of these when the project in question was under development and they were duly taken into consideration.

"Over a period of some months, we have in fact been investigating the general problems associated with the use of currently available FETs in various circuit configurations. In the investigation, we have made considerable use of a digital computer in performing the many tedious calculations involved. As a further part of the investigation we have been in correspondence with the various FET manufacturers.

"One outcome to date has been some rather interesting findings concerning the practicability or otherwise of an attractively priced FET voltmeter, and an article discussing these findings appeared in the July issue.

"But, to return to the FET preamp, we felt justified in publishing the design we did and at the time we did for the following reasons:

(a) We are under constant pressure from readers to be "with it"—to give them information, both theoretical and practical, on new devices and techniques as soon as we possibly can. As with any commercial enterprise, we have to produce the best possible result from the time which can reasonably be alloted to a particular line of investigation. In the case of the FET preamplifier, the result was a practical unit; in the case of the FET voltmeter, it was an article deliberately setting aside the idea for the time being.

(b) During the development of the preamp in question quite a deal of effort was directed toward ensuring that the design would operate both well and reliably. Before the article was prepared we tried quite a number of sample FETs and transistors in circuit and verified that the specified performance could be achieved.

(c) With the devices which we were able to test in the prototype, its performance in the intended application was very pleasing, and well within the usual criteria of acceptable performance. Indeed in comparison with our other preamp. designs—one of which is rather similar to your own preferred circuit—it seemed to offer a significant reduction in cost and complexity, while giving a very similar order of performance.

(d) In the article itself, we took some pains to make it clear that as a result of the considerable spread in FET parameters it was highly desirable that the operating conditions of the circuit be checked upon switch-on and, if necessary, altered to bring them within the appropriate range.

"While making the above points, I would nevertheless add that, at this stage, I am not too happy about the strict theoretical suitability of the 2N4360 device for a majority of common applications. Its parameter spreads would certainly appear to make it extremely difficult to design most common DC configurations to accept any randomly chosen sample on a 'drop-in' basis.

"I find rather puzzling the suggestion that our preamp. involves increased cost and complexity, while offering a lower standard of performance. In fact, there would appear to be little difference in either cost or complexity between the published circuit and the conventional preamplifier which you favour. The question of performance has been dealt with earlier, I hope adequately.

"Finally with regard to the instability problem it would indeed seem likely that electrolytic tolerances could be to blame. We certainly found that both the 100ohm DC feedback resistor and the supply both had to be quite solidly bypassed for adequate LF stability."

And that should be enough, for one month, about preamplifiers and FET's in particular. Readers will have noticed that, in last month's issue, we preferred a preamplifier using conventional transistor circuity for the 118 Playmaster, for the reasons stated in the issue.

In point of fact, the average user will be a lot less concerned about what is behind the panel, than designers who are prone to argue about the niceties of circuitry. Provided a preamplifier gives the required gain and frequency response and is not noticeably poor in terms of distortion, noise level and stability, the user will be happy. And, as far as we can gather from constructors of both types, the users are happy! ◻

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Installing A Burglar Alarm

This article was prompted partly by a number of requests we have had from readers, and partly by the attention drawn to property protection in general by recent police statements. This caused us to seek out the writer who contributed an article on this subject many years ago. The result is a new article, updated in the light of experience and the availability of modern components. It should be well within the capabilities of the average reader.

In the October 1953 issue of "Radio and Hobbies" the writer described a burglar installation which he had recently fitted to his own home. That installation was prompted by two visits from the disciples of Bill Sykes, and the writer was determined not to be caught a third time. The installation did a good job for several years even though, as it turned out, it was never "fired in anger." Nevertheless, the peace of mind which such a system provides justifies the cost and effort many times over. No longer are periods away from the house filled with nagging fears that someone may have broken in; that one will return to find the house ransacked and valuables stolen. Such worry — and the freedom from it — has to be experienced to be understood.

Later, in a new house in a new suburb I had to reassess the situation. At first there was little inclination to install a new system, partly because there seemed to be so many other things to do, and partly because the bushland setting of an "outer suburb" seemed hardly the place for burglars.

More recently, the situation has changed. What was once an "outer suburb" has now been overtaken by the suburban sprawl. With it came the realisation that the risk was now just as great as it had once been in the "inner suburbs." Any lingering doubts on this score were quickly dispelled by reports of court proceedings in the "local rag." Not only could it happen here; it was happening.

I made up my mind to get in first.

A new installation, in a house that was owned rather than rented, provided an excellent opportunity to apply some of the lessons learned from the first installation. Broadly, these involved the following factors, in approximate order of importance. (1) Reliability of door and window contacts. (2) Battery drain. (3) Method of legitimate entry. (4) Concealment of wiring and contacts.

Before dealing with these subjects in detail, let us first consider the general concept of an alarm system and typical circuitry.

Most domestic alarms work on the principle of providing a very loud alarm, usually outside the house, though well hidden, which will be clearly audible at least to neighbours on either side and preferably further away than this. Whether such neighbours are willing or able to summon assistance when the alarm goes off is really of little importance, because no prospective burglar will wait around to find out.

Most of them will cover the first hundred yards in even time, fences and other minor obstacles notwithstanding.

An alternative arrangement is one where it is desired to provide protection for a building remote from the main residence, such as a lockup shop, garage, "ham shack" or workshop. In this case it is preferable to provide a small bell, or even a buzzer, which will be audible only within the residence. In these circumstances an intruder need not know that his presence has been detected until a man in blue appears at his side and begins to ask certain awkward questions. Police officers to whom I have spoken on the matter agree that such systems result in a high percentage of catches.

It is usual with such systems to provide a large outdoor bell which can be switched into circuit when both premises are unattended, thus providing protection by the "scare" method.

Many commercial systems provide what might be termed the ultimate in protection by connecting each building to be protected to a central switchboard manned continuously by officers of the company providing the service. Connection from the building to the switchboard is by means of telephone lines provided by the P.M.G.'s Department and the occupier of the premises pays an annual rental for the entire service. Schemes like this, of course, are outside the scope of the amateur, but are mentioned as a matter of interest.

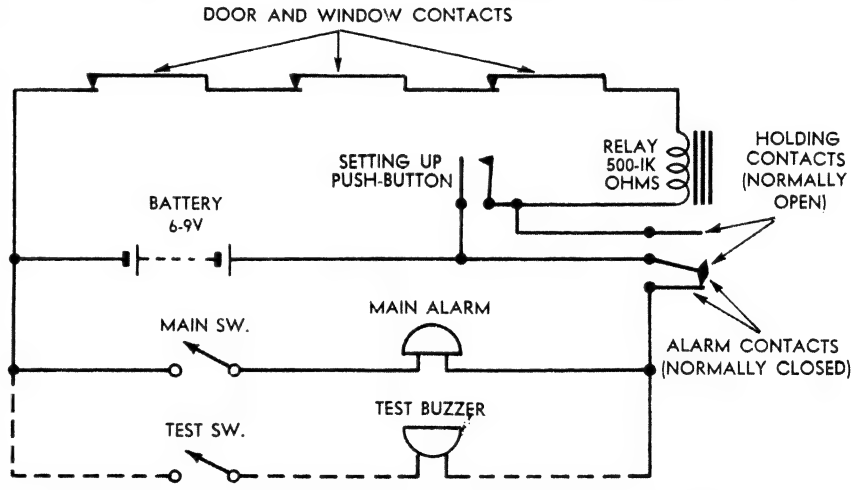
Coming back to more practical considerations for a domestic circuit we have to consider first whether to use a closed-circuit or open-circuit system. There are points in favour of both systems, though the closed circuit system is generally preferred.

The open-circuit system is one where the alarm bell is connected directly to the various door and window contacts so that the closing of any set of contacts, by opening the door or window, will cause the alarm to ring. Various schemes are used to ensure that the bell will keep ringing, even if the circuit is opened again immediately. The disadvantages of this scheme may be summarised as follows. Vital wiring of the system must be taken to each possible entry point, thus creating the risk of the system being rendered inoperative by a would-be intruder cutting the wires or tampering with the contacts.

A second point is the possible failure of a particular set of contacts to close the circuit properly. To ensure that the system is always working, it is necessary to test all the contacts at fairly frequent intervals. Many non-technical owners do not fully appreciate this and are content to test the circuit by opening an odd door or window and being satisfied if the alarm operates.

On the credit side it must be conceded that such systems are less prone to false alarms than other systems, as well as being lighter on battery current. In fact, the batteries should have a life almost equal to their shelf life, since they will have only a brief drain imposed on them for testing at well-spaced intervals.

The closed-circuit system operates on the principle of using a circuit through the window and door contacts to hold in a relay. A pair of "normally closed" contacts on the relay are thus held open and, since they form part of the main bell circuit, the bell is prevented from ringing. Opening a door or window will open the relay circuit, allow the relay to drop out, and close the main bell circuit. As with the open-circuit system the bell will continue to ring until a local circuit is interrupted. Obviously there is little chance of the contacts failing to



The basic circuit of an alarm system. The buzzer may be used to check that the relay is set, or a small globe may be substituted for it. Alternatively, the buzzer may be used for night time monitoring.

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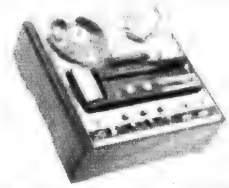

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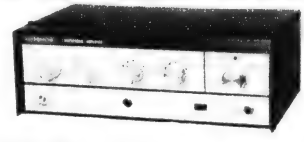

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MICRO MA-77S and MA-77 TONE ARMS

Very similar in construction to the MA-88, these tone arms are 12 in. and 14 in. long respectively. A unique eccentric counter balance weight is employed with the "77" series. Connections of all MICRO arms are plug-in types to eliminate soldering, general construction is of machined solid brass and finish is satin chrome. All MICRO arms pivot on miniature ball races. Both these models incorporate the bias hook and weight system to eradicate lateral pressure. **Encel price** **$29.50**

READ THE REVIEWS!

Your April, 1966, copy of "Electronics Australia" contains a review of the MICRO MA-77 tone arm on pages 126-127. If you subscribe to "Hi-Fi News" look up your February, 1966, copy for an extensive review of the MICRO MA-77 tone arm and the M-2000/5 magnetic cartridge. This particular review extends over 4 pages! Ask for copies!

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For only $19.50 you can now purchase a top quality magnetic cartridge with a diamond stylus . . . the Micro VF-3000. Response is 20-25,000 Hz. The lower priced Micro M 2000/5 is of similar electronic design and has a response of 20-22,000 Hz. . . . price is $16.50. Both models feature a 15° vertical tracking angle. Performance is comparable with cartridges twice the Encel price . . . call into your nearest Encel Stereo Centre and **hear** the difference! And here's special news . . . the VF-3000 has now been released with an 0.3 x 0.8 mil. elliptical diamond stylus for only $24.50! VF-3000/E: $24.50. VF-3000/5: $19.50. M-2000/5: **$16.50**

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operate, while a cut wire will also operate the alarm.

In all fairness it must be admitted that the closed-circuit system also has disadvantages. The natural tendency is to a false alarm if the contacts are faulty and too many of these can nullify the whole purpose of the scheme. Since there is a continuous drain on the batteries while the system is set up they will have a much shorter life, though most people still consider that the few cents a week running cost is cheap insurance.

All things considered, and assuming that the weak points of the system are recognised and allowed for in designing the installation, the closed-circuit system is to be preferred.

The accompanying circuit will give some idea of the practical application of the principles just explained. It will be seen that the battery, door and window contacts, the relay coil, and a set of contacts on the relay all form a series circuit. The purpose of the relay contacts is to provide the continuous-ringing feature and their operation is quite easy to follow. Assuming for the moment that the relay is being held in, it can be seen that the current through the coil must flow through the relay's own contacts in order to hold it in. In other words, the contacts are what are known as "self-holding" contacts. It is easy to appreciate that such a relay cannot pull in again once it has dropped out because it will have opened its own coil circuit. Thus, once the alarm is started, it cannot be stopped by simply restoring the contact circuit.

Obviously, some method must be provided to cause the relay to pull in whenever the system is to be set. One way would be to simply push the relay in by hand, but this has the disadvantage that the relay may not always be conveniently located, plus the far more important problem of protecting the relay contacts. Because of the inductive nature of the circuit, due to the relay coil, considerable sparking can occur when the circuit is broken. Theoretically, this should not be a problem when the relay is being pushed in but, in practice, it is possible for the current to vary both up and down at the moment of contact, particularly if the person concerned does not appreciate the need to make a quick and positive movement.

A far better arrangement is to connect a push button across the holding contacts so that they are momentarily short circuited as the button is pressed. This causes the relay to pull in, holding in on its own contacts when the button is released. This enables the holding contacts to operate under the ideal conditions of never having to either make or break a circuit, the make occurring through the push button and the break at whatever set of contacts are broken first when unsetting the system. This is important because failure of the holding contacts could cause a false alarm.

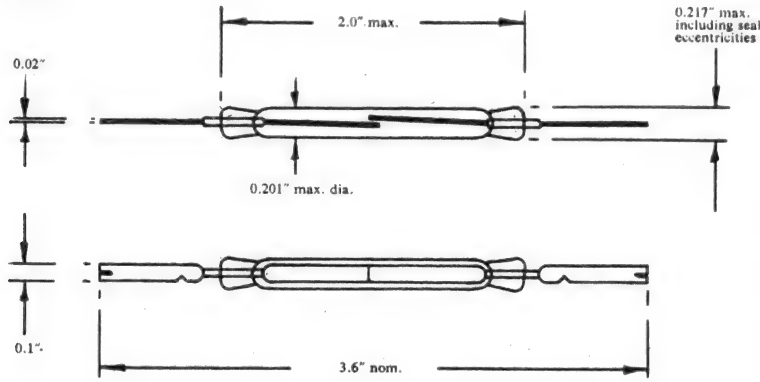
In setting the system, therefore, one simply makes sure that all the windows and doors are closed, that a method of exit from the building has been provided (more about this later), and then presses the relay setting button. If all contacts are closed the relay will be heard to pull in, after which the main bell switch may be closed and the system is set. To unset the system it is only necessary to open the main bell switch, the relay automatically dropping out with the first window or door opened.

Coming to the more practical aspects of the system, the first point to be considered is the provision of door and window contacts which will be absolutely reliable in all circumstances. This was a problem with the original system. Although it did a good job, one of the first lessons learned was that, no matter how corrosion-resistant the material used for the contacts, and in spite of a self-cleaning action built into each contact system, high humidity and industrial contamination could increase contact resistance to the point where false alarms occurred.

This was only overcome by adopting a routine of cleaning all contacts, using a proprietary contact cleaner at regular intervals of three or four months. While not a back-breaking task, it was a nuisance and an obvious weakness in the system. It could possibly have been overcome, or at least minimised, by employing commercial micro switches, but these items are quite expensive and, in addition, would have required a lot of work to fit in place of the ones already in use.

With a new installation contemplated, this was regarded as the number one problem to be solved. Micro switches were again considered, in spite of the relatively high cost, but before a decision could be made I was introduced to the dry reed switch. Immediately I saw it

DIMENSIONS



The heart of the system is the dry reed switch. The Hivac type XS7, illustrated here, has been specially designed for the low current conditions and prolonged closure times inherent in alarm systems.

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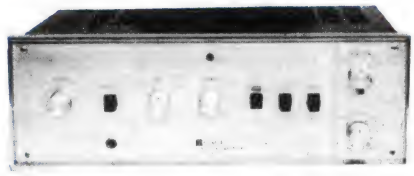
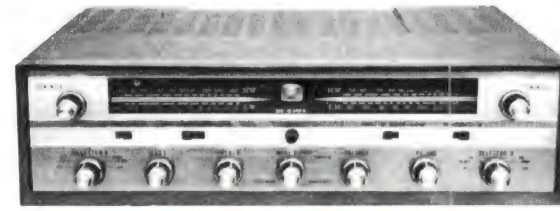


Music Power:	30 watts total.
Audio Circuitry:	Power tubes 6BM8 ECL82 pushpull output circuit. 2 channels.
Harmonic Distortion:	Less than 1% (at rated output).
Frequency Response:	Plus/minus 1 db. From 30—20,000 cps over-all
Audio Sensitivity:	MAG PHONO: 2.3 mV. CER PHONO: 38 mV. TAPE HEAD: 1.5 mV TAPE P.B. (MONI): 150 mV. AUX: 150 mV.
Terminals:	8 or 16 ohms speaker output, headphone jack. TAPE REC Jack. TAPE MONITOR switch. TAPE REC P.B. Jack (DIN standard).
Equalisation:	PHONO: RIAA TAPE: NAB.
Tone Controls:	BASS, TREBLE.
Loudness Contour:	ON-OFF switch.
Power Supply:	230 V. AC 50.

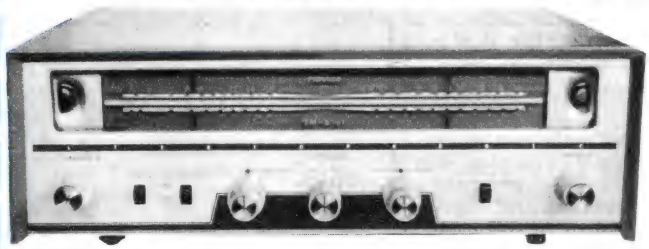
40 WATTS FM/MW-MW/SW STEREO RECEIVER-AMPLIFIER

Music Power:	40 watts total.
FM Tuning Range:	80-108 mc.
FM Usable Sensitivity:	10 uV (IHF).
AM Tuning Range:	MW: 535-1,605 kc. SW: 3.8-12 mc.
AM Maximum Sensitivity:	MW: 13 uV. SW: 13 uV (at 1 mc, 500 mW output 30% modulation).
Audio Circuitry:	Power tubes 6BQ5 EL84 pushpull output circuit. 2 channels.
Frequency Response:	Plus minus 1 db, from 20—20,000 cps over-all.
Audio Sensitivity:	MAG PHONO: 3.4 mV. CER PHONO: 38 mV. TAPE MONI:: 160 mV. AUX: 160 mV.
Terminals:	4, 8, 16 ohms. TAPE REC Jack. TAPE REC/ P.B. connector equipped with TAPE MONITOR switch, for centre channel amplifier.
Equalisation:	PHONO: RIAA.
Tone Controls:	BASS, TREBLE.
Filters:	RUMBLE: cut 8 db (50 cps). SCRATCH: cut 20 db (7,000 cps). WHISTLE: cut 30 db (10,000 cps).
Loudness Contour:	ON-OFF switch.
Power Supply:	230 V. AC 50.



Model SM-Q300B

22 WATTS SW/MW-MW STEREO RECEIVER AMPLIFIER

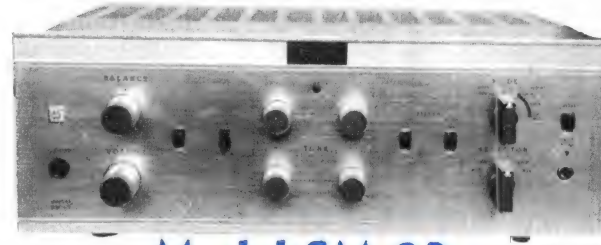


Music Power:	22 watts total.
Tuning Range:	MW: 535-1,605 kc. SW: 3.8-12mc.
Audio Circuitry:	Power tubes 6BM8/ECL82 pushpull output circuit, 2 channels.
Frequency Response:	Plus/minus 1 db, from 20-20,000cps over-all.
Audio Sensitivity:	MAG PHONO, 2mV, CER PHONO: 23mV. AUX: 115 mV.
Terminals:	4, 8, 16 ohms. TAPE REC Jack
Equalisation:	PHONO: RIAA.
Tone Controls:	BASS, TREBLE.
Loudness Contour:	ON-OFF switch.
Power Supply:	230V. AC 50.

Model SM-B161

80 WATT STEREOPHONIC PREAMPLIFIER-AMPLIFIER

Music Power Output:	40 watts per channel.
RMS Rated Power Output:	Plus/minus 1 db, from 15 cps to 100,000 cps.
Harmonic Distortion:	Less than 1% (at rated output).
Damping Factor:	13.
Hum and Noise (at rated output):	Magnetic, more than 60 db below full output. Auxiliary, more than 80 db below full output.
Input and Audio Sensitivity:	Tape head 2mV. Magnetic 3mV. Mic 2mV. Crystal (Ceramic) 25 mV. Auxiliary 150 mV. Tape Play 200 mV.
Bass Control:	Boost 13 db. Cut 13 db, at 50 cps.
Treble Control:	Boost 13 db. Cut 13 db. at 10,000 cps.
Filters:	High cut minus 10 db at 10,000 cps. Low cut minus 8 db. at 50 cps.
Equalisation:	Phono-RIAA Tape-NARTB.
Power Supply:	Silicon Diode Rectifier circuit.
Power Requirements:	230 volts, 7 amp. 145 watts (max.) 50-60 cps.
Tubes:	12AX7 ECC83X3 6AN8X2. 7189AX4, SE-05BX2 (Silicon Diode).



Model SM-83

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and learned its characteristics I knew the search was over. Although designed for a completely different purpose, it is difficult to envisage a better device, had it been made for the job.

For a detailed description readers are referred to "ELECTRONICS Australia" for August, 1965. Briefly, it consists of two overlapping magnetic reeds sealed in a glass tube. Normally they do not touch but, when made part of a magnetic circuit, they are attracted to each other and make contact. The magnetic field may be supplied by either an electromagnet or a permanent magnet, the latter being used in this application.

These switches are most conveniently fitted to a door or window frame by mounting them in a channel cut in the woodwork. Then, after soldering the terminals to the wires, the channel is filled with plastic wood or similar material, sanded flush and repainted. Assuming even moderate woodworking ability, the finished job will be virtually invisible.

About the easiest way to cut the channel is with a small (5in) power saw, fitted with a "wobble" or "drunken" setting. This should be adjusted to cut a channel about ¼in wide and ¼in deep. It should accommodate the switch comfortably, with sufficient clearance at the top to allow the filling material to cover it completely. The setting of the saw should be tried out on some scrap timber first and, once set, it is a good idea to try to leave it that way. In assessing the depth and width of the channel allow room for one wire to run parallel with the glass tube.

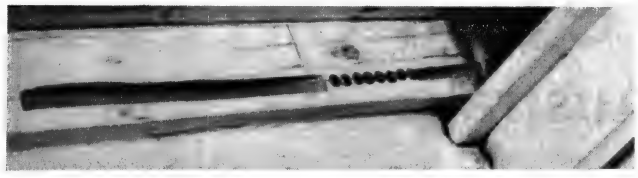
To cut a channel in a door or window frame, the saw needs to be lowered into the wood while it is rotating. This is not difficult provided it is done SLOWLY. Let the saw make its own pace, otherwise there may be a tendency for it to kick. Also make sure the saw blade is sharp and in good condition. When working near the corner of a frame — a position which often makes wiring easier — start with the saw facing the corner and with the front of the saw about 2in (the length of the switch body) away from it. Lower the saw gently with the blade revolving and allow it to reach its full depth. Then move the saw forward as far as it will go. In such a channel the curved ends accommodate the terminals.

In the case of door frames it is usually convenient to bring the wires into the channel from inside the framework via two holes drilled through the bottom of the channel. In the case of a window sill this cannot be done, since such holes would involve the flashing under the sill and result in water entering the cavity. It is better to extend the channel into the weight cavity. This may be done by drilling a series of holes in line with the channel, then breaking down the walls between them. An easy way to do this is to put the drill in the last hole (in the corner), lean the drill backwards at about 45 degrees, switch on, and draw the drill towards you. The same method may be used to cut the whole channel if a power saw is not available.

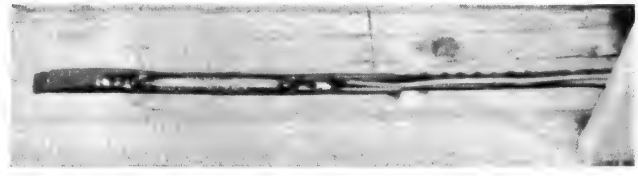
Assuming the wires are available to run into the channel at this time, they may be trimmed and soldered to the switch terminals. (The axial rotation of the switch is not important.) Before filling the channel it is important to ensure that the associated magnet can be correctly located on the door or window, and appropriate marks to identify the position should be on the door or window, rather than the frame, where they could be obliterated by subsequent operations.

In the case of a window, good use can be made of a length of sticky tape. Use about four inches of tape and lay it face up across the channel at right angles to it and equidistant on either side. Place the magnet on top of the tape exactly over the centre of the reed switch and running parallel to it. Lower the window gently on to the magnet, making sure that the window is approximately centred in regard to any side to side movement. Strap the magnet to the frame with the two ends of the sticky tape, raise the window, and mark the magnet position with a sharp pencil. A recess for the magnet may be cut immediately, or left until a more convenient time.

There are a number of preparations which can be used to fill the channel. These include various forms of plastic wood or wood putty, as well as the wide range of epoxy type mixtures currently



Channel cut in sill with power saw, extended into corner with row of holes, shown partly routed.

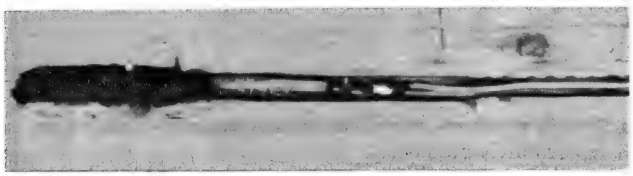


Reed switch and connecting wires in place in the channel. Mark magnet position on window frame.

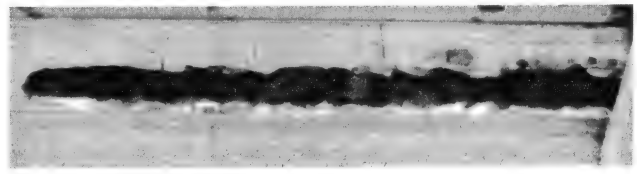
With the reed switch mounted on the door or window frame, and the permanent magnet on the door or window, we have a near perfect proximity switch.

The reed switch, being sealed, is virtually immune to contamination of any kind. It is small and lends itself to easy concealment, aided by the fact that there is no need for any electrical contact between the door or window and the frame. Even when carrying current values many times higher than required in this role, the makers claim a life expectancy of 100 million operations. And, to cap it all, the price is extremely reasonable.

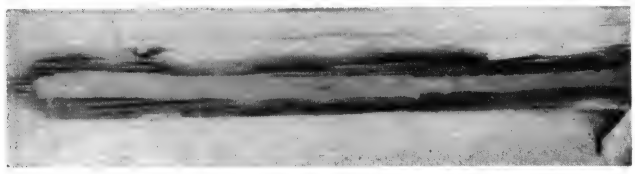
The reed switches used by the writer were the Hivac type XS2/2, which are handled in Australia by the Imported Components Division of Ducon Condenser Pty. Ltd., Box 2 Villawood, N.S.W. Normally such items can be obtained from the larger wholesale or retail suppliers, to order. More recently, Hivac have introduced a unit specially developed for this application — they are being used in large numbers by professional protection companies — and this would be the logical one to obtain. It is the type XS7. Both types have similar dimensions: 0.217in diameter, 2in long (body), 2.75in overall (including terminals) for the XS2/2, and 3.6in for the XS7.



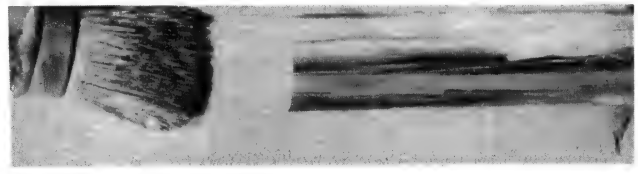
Channel partially filled. Keep filling mixture thin and coax it down each side of switch.



Channel completely filled. Note that filling material is above sill height to allow for shrinkage.



Filling sanded back to wood level. Outline of original channel can be clearly seen.



First coat of paint, applied to damaged area only. Additional coats are applied to the whole sill.

available. The latter do a very good job and are particularly useful in some special applications, but are rather expensive if used in large quantities. For the most part the plastic wood type materials are adequate, and a good deal cheaper. Typical brands on the Australian market are "Duco" or "Selleys" plastic wood, "Wattyl" lacquer putty and, in the epoxies, "Selleys" Plastic Porcelain, Panel Metal, Araldite and a number of similar products. The Plastic Porcelain is white, and will approximately match most white paint used on door and window frames.

A typical application of plastic wood or lacquer putty is on a window sill, as shown in the photographs. This material shrinks quite significantly when it dries, and the channel should be overfilled by at least 1/8in. It will take about 24 hours to set hard enough to be sanded. Any tendency to soften when a sanding disc is applied indicates it has not set properly. When sanded down to approximately wood level it will probably be found that one or two bubbles have occurred, leaving small holes or cracks. These should be filled and left to set before the final sanding. When the sanding is complete, one or two coats of paint, over the whole of the sill, will hide all traces of the work.

In the case of doors, there is usually a clearance between the door and the frame and this may result in more space between the magnet and the reed switch than can be tolerated if the magnet is recessed flush with the wood. A solution is to fit the switch into the top of the door frame and the magnet to the top of the door, either not recessed at all, or no more than is necessary to clear the frame.

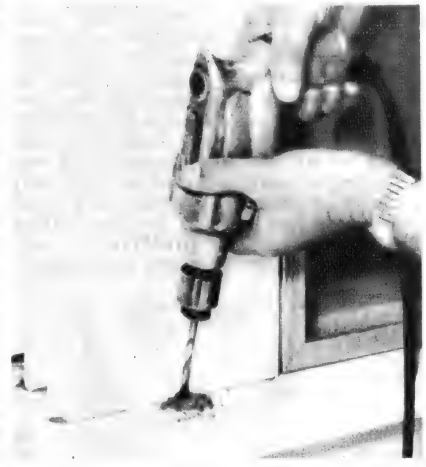
In this case plastic wood materials are less satisfactory as a channel filler. They tend to sag under their own weight and, if covered to prevent this, take a long time to dry. The epoxy mixtures, on the other hand, may be secured with a strip of sticky tape and will "cure" by their own chemical action. A small quantity of the same mixture may be used to fasten the magnet to the top of the door.

Similarly, when a magnet is recessed into the underside of a window frame, the epoxy mixture is easier to handle than putty. In the relatively small quantities needed for these jobs, the higher cost is not so serious.

The magnets used were purchased from Rola Company (Aust.) Pty. Ltd. Two sizes were used, from the range of what are known as "stick cast" magnets. Type FM454 measures ¾in x 3/8in x 7/32in, will close a type XS2/2 switch at 3/8in, and release it at 5/8in. It is suitable for most situations, such as those already discussed. Type FM448 measures 1-15/16in x 13/32in x 3/16in, will close an XS2/2 at 1¼in, and release it at 1-5/8in. It is useful in special applications where a greater separation between magnet and switch cannot be avoided.

In all cases it is advisable to check that any magnet/switch combination will work in the positions they are to occupy, before either is permanently sealed in place. These magnets will normally retain their magnetism indefinitely, but avoid packing or other conditions where two magnets are trying to repel each other. This can seriously weaken them.

A typical aplication for the larger magnet is where a door frame is polished rather than painted, and the handyman may doubt his ability to match this finish if a channel is cut in the woodwork. In such cases the switch may be mounted on the other side or the door frame, i.e., behind the architrave. The magnetic circuit is extended from the switch through the frame by means of two heavy nails (about 8 gauge). These should be about 2½in long, or cut to this length and the pointed portion discarded. To facilitate driving them through the frame, and to ensure that they are accurately located, a pilot hole is drilled for each, using a drill of about half the nail diameter.



Drilling a cable hole through the sill. A slight backward angle may assist wire routing underneath.

Drilling cable hole into weight cavity. Holes may be repaired using plastic wood or epoxy compounds.

The nails are spaced approximately 2in apart but, ideally, should be slightly angled so that the heads (nearest the magnet) are a little less than this to match the 1-15/16in length of the magnet, and a little more on the other side of the frame to match the 2in length of the switch. The switch is mounted between the nails, with the flat of the terminals resting against them, and held in place with one of the epoxy compounds.

The magnet may be accommodated on the top of the door as previously suggested, assuming that this is a convenient place to locate the switch. If it is more convenient to use the side of the frame, the magnet may be recessed into one of the tenons of the top or bottom rail of

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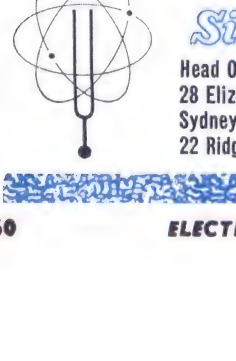

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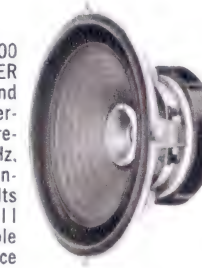

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the door. Since this involves the end grain of the timber, it is relatively easy to cut the recess, and it will be found that the tenon is usually very close to the same size as the magnet. The magnet will not be obtrusive in this position since the tenon normally breaks the smooth surface anyway.

Next, the wiring. How this is carried out will depend a lot on the type of house, i.e., brick, weatherboard, fibro, etc., but some factors are common. For example, it is worthwhile going to some trouble to conceal the wiring, usually by getting it into the wall cavity from each point, and then either into the ceiling or under the floor for routing to the control panel. With a little care it is possible to install a system which will display no clues as to its existence.

Just how important this is is the subject of some debate. There are those who feel that there is merit in advertising the existence of an alarm, on the basis that this will discourage a potential burglar. On the other hand, the writer feels that the element of surprise is the householders strongest weapon. A burglar who knows an alarm system exists is half way towards finding a way to circumvent it, assuming he feels that this is worthwhile.

And, particularly where shops and stores are concerned, the value of the contents is often quite sufficient to tempt a burglar to "have a go," even if he has to spend a lot of time sizing up the situation before he strikes. Any part of an alarm system which is visible not only warns of its existence, but may easily give a clue as to how the system works and, therefore, how best to beat it. The less that is visible, therefore, the better. The following points are based on the writer's experiences, but obviously cannot cover all situations. Where strange ones are encountered, the individual can probably work out a solution for himself.

Where it is planned to locate a switch in the top of a door frame, it is usually worthwhile to remove the outside architrave on the lock side of the frame. This will give access to both the side (directly) and the top (indirectly). If the switch is located close to this top corner of the frame — which is a good place anyway — then it is a simple matter to feed a "fish wire" into the space above the frame through a hole in the channel, coax it out the end where the architrave is removed, and use it to draw the circuit wire back into the channel. If the wire is to go under the house it may be run down the side of the frame and through the floor.

If it is to go into the ceiling it should still be possible to gain access to the wall cavity from the corner of the door frame, but it may be easier to feed a fish wire down from the ceiling, "hook it" from the access point at the frame corner, and then use it to draw the circuit wire back up into the ceiling.

Removing an architrave normally is not difficult. Painted architraves (such as the outside ones) should be selected in preference to stained or polished ones, since any minor damage is easily repaired with putty and paint. If old nails have to be withdrawn from timber before it is replaced, less damage will be done if the heads are pulled right through the timber from the back, rather than driven out the front.

In the case of box frame windows the best approach seems to be to get the wiring into the weight cavity, on the most convenient side in the case of a single window, or the centre in the case of a double window. From here it is brought out the front of the cavity through a hole drilled at sill level, then through the sill via another hole. A certain amount of improvised "routing" with the drill, in the vicinity of the junction of these two holes, will allow the wire to be recessed. The holes may be filled with putty or epoxy.

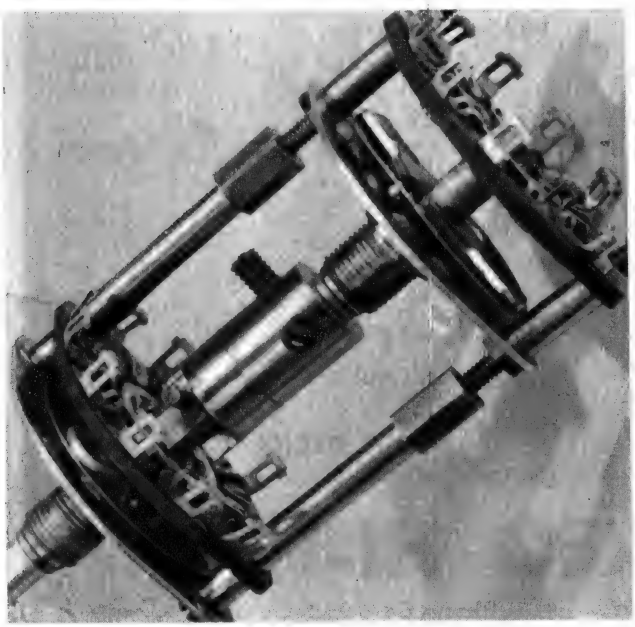
Once under the sill there are a number of possible ways in which the wire may be routed. One of the easiest is to simply force it between the bottom of the sill and the moulding beneath it, prising these two pieces of wood apart slightly if necessary. This will allow the wire to be run to the end of the sill, or any intermediate point where another path is available. Where fibro cement is used a cover strip may be lifted and the wire run under this either up or down as required. Before embarking on such work, make sure that matching paint is available to repair any minor damage that may occur.

In the case of brick walls, it has been suggested that a channel, deep enough to accommodate the wire, could be scraped in the mortar, then sealed with a fresh coat of mortar. The success of such a scheme would depend on how well the new mortar could be made to match the old, and the skill with which the job was finished. Weatherboard finishes are probably easiest to deal with, since any holes or channels which are needed can usually be filled and finished using normal woodworking materials and techniques.

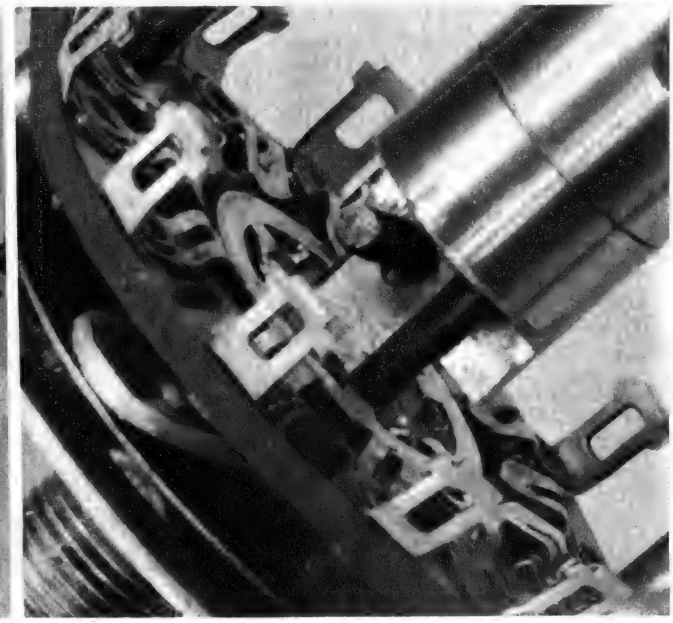
The technique of "hooking" wire fed into a cavity is extremely useful, though it sometimes calls for a little patience. On an average however, one will usually hook the wire within a few minutes. The writer used a hook made from a length of soft iron packing case wire, about 16 gauge. A reasonable size hole should be drilled in the top or bottom wall plates, say $\frac{3}{8}$in or $\frac{1}{2}$in, using an auger bit. Make the hook as large as possible, consistent with the need to go through the hole, and feed as much wire as possible into the cavity from the other end. This can be scrap wire if necessary.

In fishing for the wire, let the hook wire assume some curvature so that it approaches the horizontal as it is fed in. Then, if the first few tentative tries are unsuccessful, bend the wire in to a crude crank and rotate the hook so that it thrashes around inside the cavity. This usually brings results.

The most convenient wire to use for the contact circuit is ordinary bell wire, preferably in "twin" formation. The official description of the wire used by the writer is "1/.028 Twin Figure 8 Extra L.T. P.V.C. Insulated Bell Wire." It is available in 100yd rolls. Its small size makes it very easy to coax it into cracks betwen timber, fibro, etc.



Two figure combination switch constructed from standard switch parts. A more compact (shorter) version is probably possible.



Closeup of the "backlash" mechanism in the switch on the left. The switch needs only one indexing ball in each clicker plate.

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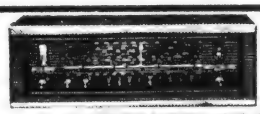

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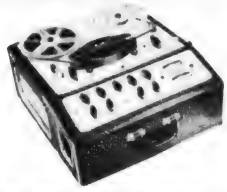

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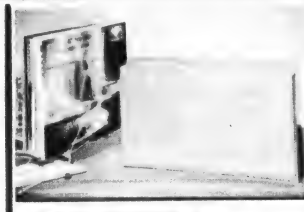

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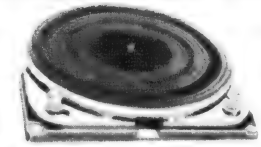

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NO PARKING RESTRICTIONS

In actually running the wires from each point to the control panel, one has a choice of two approaches: (1) Run a single wire from each point to the next, forming a single loop right round the building, or (2) bring each point — or group of points — back to the control point as an independent pair, the various pairs then being connected in series at the control point.

Arrangement (1) has the advantage of simplicity and that it uses a minimum of wire, but (2) has some advantages which may be worth considering. The main one is that it becomes possible to determine with a meter system, from the control point, just which entry point (or group) is open circuit in the event that the alarm is tripped, or will not set. The latter is the most useful asset. When setting up the system before leaving the house it is most disconcerting to find that it will not set, due to some window being not quite closed. Much time can be saved if one can determine even the room in which the defect is present.

It is even more disconcerting if the alarm raises one from a sound sleep in the middle of the night — assuming the worst should happen — and, having switched it off while still half asleep, one stands by the control panel wondering where the heck the thing has been tripped. This is particularly so where outbuildings form part of the system.

In any case, where outbuildings are involved, it is desirable to keep these circuits separate beyond the control panel. Then, by suitable switching, it is possible to set the alarm for this part of the system only, providing protection for the remote buildings at any time that the main building is occupied.

The writer has not provided such refinements yet, but has wired the system for them on, roughly, a room-by-room basis. The indicator will probably have to be meter movement (one of the cheaper variety), capable of being switched across each circuit. This may double as a voltmeter for battery checking.

As intimated earlier, the whole success of an alarm system depends on its ability to make plenty of noise. For this reason a really good bell is essential and the inexpensive types normally used for door bells are quite useless. What is required is a large bell, specially designed for this kind of work and having at least a 10in diameter gong. It should also be a "weather clad" type. Such bells are normally available from electrical supply houses or from firms associated with commercial burglar alarm installations. They are not cheap, but are still a good investment when one considers the likely loss involved in a single burglary.

They are available in a range of voltage ratings, from six to 240, the six volt types being normally used for domestic installations. However, many profesional systems use a 6V bell with a 9V battery, to increase the sound from the bell. Such bells seem well able to cope with this overload.

Alternative forms of alarm which might be considered are motor car horns and relatively high powered audio oscillators operating into a large loudspeaker ("Industrial Electronic Alarm," June, 1963). An advantage of either of these systems is that they lend themselves to concealment behind a wall with only a small grille type opening for the sound. They may also be cheaper than some bells.

A disadvantage of the car horn is that it draws a lot of current — more than could be supplied by dry batteries or handled by the normal type of relay. An accumulator and an extra relay, of the type used for this function in cars, would be essential. Also, the sound made by either the car horn or the oscillator, may not be as readily recognised as a burglar alarm, as would the bell.

Whatever kind of alarm is chosen it must be located where it can be heard but not seen or be readily accessible by anyone disposed to tamper with it. Some commercial systems provide two bells, so conected into the system that any attempt to tamper with one will trip the relay and set the other ringing. This may be more elaborate than is justified in many cases, but may be considered where it is difficult to conceal the bell adequately.

In one installation which the writer has seen, the bell was located under an iron roof. Most of the loss of sound which such a position would normally create was overcome by arranging that a particular part of the gong rested against the iron. The position on the circumference of the gong was carefully selected so that the presence of the iron did not dampen the vibration of the gong, but rather conveyed the vibrations to the iron. As a result, the whole roof resounds to the noise of the bell.

The wiring to the alarm should introduce a minimum of resistance in order that the best use be made of the available battery voltage. Twin nylex sheathed power cable (1/.064) is eminently suitable and, if fitted with an earth wire as well, this can be paralleled with one of the other conductors to further reduce resistance. This is particularly desirable if a long run is involved.

Battery operation is virtually essential for any alarm system. Mains operation leaves the system vulnerable to anyone who cares to turn off the main switch, which is normally readily accessible. Also, in the event of a mains failure, even for a few seconds, the relay will drop out and set off the alarm when the power is restored. The only question which has to be decided is which type of battery should be employed.

Commercial systems prefer dry batteries for the fairly obvious reason that, apart from the need to renew them at regular intervals, they require no maintenance. A typical battery would consist of from four to six large cells, such as the Eveready No. 6. Used in a typical closed circuit system where it is set every night and for several hours a week during the day, such a set of cells should last from nine to 12 months. More recently, circuits employing solid state devices in place of, or in addition to, the relay have been developed, and these can effect a marked reduction in current drain. So far, the writer has not progressed further than scribbling a circuit on paper, but the possibilities seem very promising. Such a circuit may well swing the balance completely in favour of dry batteries.

The alternative approach is to use a small accumulator floated across a trickle charger adjusted to keep it near full charge at all times. While cheaper to run than dry batteries, it will probably cost more initially. In addition, all such systems require some maintenance,

rendering them unsuitable for non-technical users.

A large accumulator is not required, since even a small unit would operate a typical alarm bell for several hours. A motor cycle battery would be a good proposition where six volts was considered adequate for the bell or other alarm. If a higher voltage is desirable, then four single cells, giving a nominal eight volts — or a little more if on charge—would be the best approach. A typical small cell well suited to this job is the Exide DTG. They have a nominal 20 amp hour capacity and are designed to give a long service life.

In any such system the charge rate will need to be adjusted to just offset the battery losses and the drain from regular use. It should also be capable of charging at a faster rate in the event that the alarm is operated and the battery well discharged. The best way to adjust the float rate is to take frequent gravity readings, say once a week, until a minimum rate is found which will allow the gravity to be maintained. After this less frequent readings should be sufficient.

The writer was fortunate in obtaining, through disposals, a complete 6V 15 amp hour nickel cadmium battery, complete in neat wooden crate, dry, and apparently unused, for the grand sum of $5. The local agents were happy to supply electrolyte and a full set of instructions, and it was put into service without much effort. It requires very little maintenance—mainly topping up with distilled water about every six months—and will probably last a lifetime. Unfortunately, units in as good a condition as this are not often offered for sale.

The relay for this circuit is a fairly standard type which should be available from a number of sources. The contact requirement is for one "normally open" set (for the holding circuit) and a "normally closed" set (for the bell circuit). These may be separate sets or combined in what is called a "change-over set." The circuit shows the latter arrangement in use. The bell circuit will need to handle at least one amp in most cases, and this may be rather high for the small silver or platinum contacts normally fitted. Heavy duty silver contacts rated at about 3A would be better.

Although the bell circuit is inductive, the contacts will normally only ever have to close this circuit, which is much less exacting than opening it. The opening function will normally be performed by the main bell switch. The holding contacts have an even easier task; only a few milliamps of current and no requirement to either make or break a circuit.

In the interests of reliability the relay contacts, and particularly the holding contacts, should be protected from dust. A modern fully enclosed relay would be ideal but, failing this, mount the relay with the contacts vertical, so that there is less chance of dust settling on them. Consideration was given to using a suitably rated dry reed switch in this application, but investigation showed that the efficiency is relatively poor and that the battery drain would therefore be excessive. However, they may be suitable for use in conjunction with a thyristor, as already mentioned. The writer hopes to investigate this circuit as soon as time permits.

The resistance of the relay coils should be as high as possible in order to keep battery drain to a minimum, but not so high that its holding qualities are endangered. Relays vary in their efficiency but, as a general rule, a 500-ohm coil should suit a 6V system and a 1000-ohm coil a 9V system.

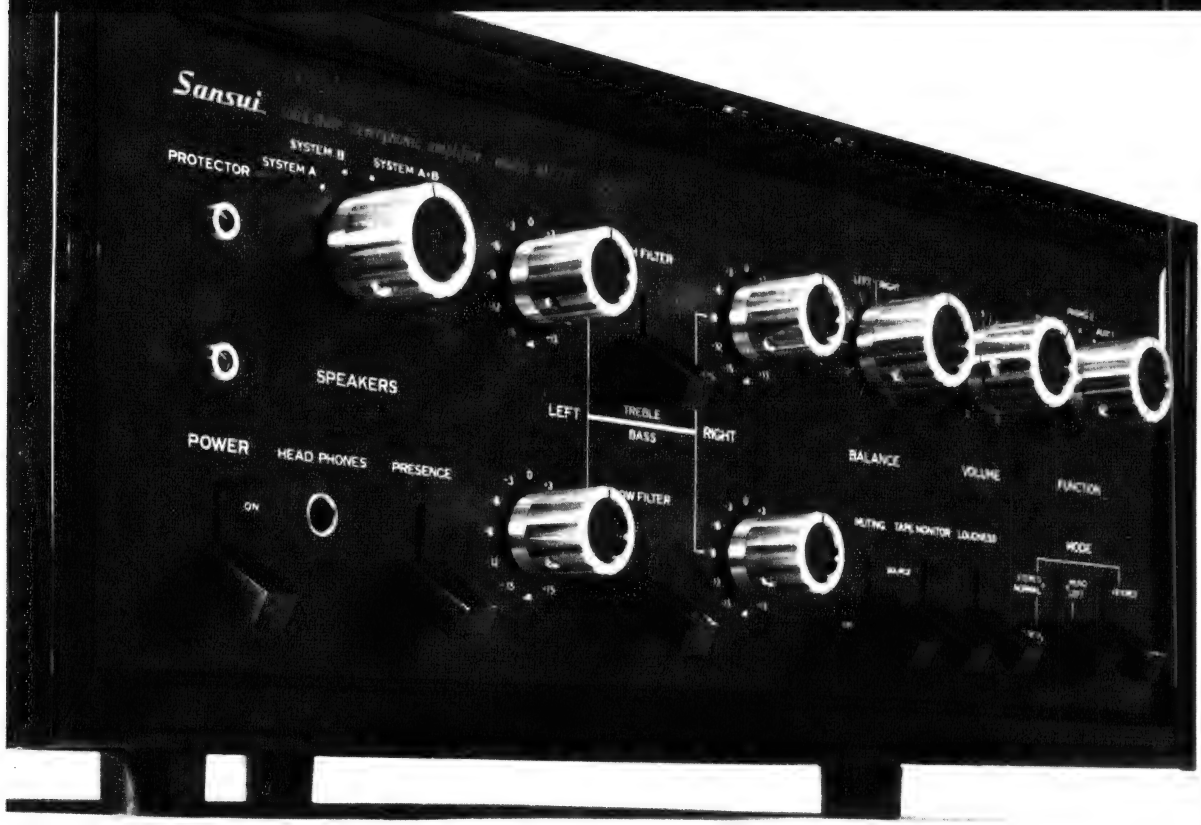
Some means must be provided for the occupant to leave and re-enter the building without setting off the alarm and without the need to create a vulnerable point in the form of an unwired door. Commercial installations usually provide a multi-position switch on or near the main entrance door, which must be set to a particular position in order to short the contacts. In use, the switch is set to a reference point, such as a stop, then clicked up to the appropriate number for the particular system. Since a would-be intruder will have only one chance to pick the right number it is unlikely that he could beat such a combination.

An alternative scheme is a plug and socket arrangement. The socket is mounted somewhere near the entrance door and the plug, which is shorted, is inserted whenever it is desired to bypass the door contacts. It is carried in one's pocket while away from the house. If a multi-pin plug and socket is used, such as the octal type, quite a complex system of cross connections is possible in both halves, making it virtually impossible for anyone to pick such a combination.

The advantage of this scheme is that, even if another person sees it used, they are little the wiser as to how it operates. Also, the presence of the plug in one's pocket is a constant reassurance that one has not forgotten to attend to this part of the alarm system. A disadvantage is that the plug can be

Wire through sill, into weight cavity, and "hooked" from the channel entrance. A single wire is usually easier to hook than a double one.

0.5%



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lost or mislaid while out, resulting in the need to trip the alarm, perhaps late at night, in order to re-enter the house.

The switch system avoids these problems, but has one of its own which may worry some people. If the switch is left set after the house is re-entered, an astute person may learn the code by simply observing the position of the knob, relative to any marks on it, or by turning it back to the stop. Such a situation is not very likely, but may be overcome by using a switch requiring a two-figure combination.

The writer made such a switch, more for the satisfaction of doing it than anything else, using standard multi-position switch parts. This has proved completely satisfactory in service. Reference to the photographs will give a good idea of how the switch is constructed. It is really two complete switch movements, consisting of clicker plate and 11-position wafer, connected in tandem. The secret is the coupler between the two sections, which introduces a deliberate backlash of several positions. Thus it is possible to set the rear switch to one position by moving the knob, say, clockwise, then the front switch to another position by moving it anti-clockwise. The two positions selected are connected in series, and the whole combination in parallel across the door contacts.

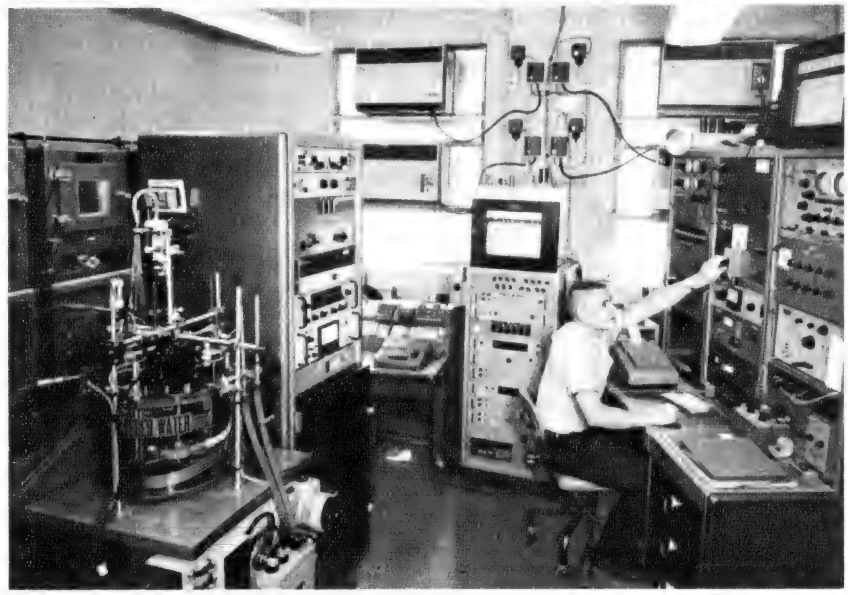
The first attempt at such a switch ignored the need for a clicker plate in the rear section, but this proved unsatisfactory and was never used. The main problem was a tendency for the rear section to "follow" the movement of the front section due to unavoidable friction between the shaft and the bush. This could have led to false alarms.

The coupling between the two sections was made from a pair of standard ¼in to ½in brass couplings, soldered together. A little more than half of one section was cut away, as shown, to give a backlash between the two movements equal to about five positions. This arrangement can be varied as desired. Some bushes may be long enough to eliminate the need to join two together. The pin through the shaft of the front section is a section of shank from a broken drill, the same size drill being used to make the hole for it. It should be a drive fit.

Such a switch may be mounted so that the knob is located on the architrave, or on the door itself. However, the latter arrangement will call for flexible leads between the door and the frame. The switch itself may be located behind the architrave, or on the inside architrave with a long shaft to the outside knob. The latter arrangement is probably safest, but calls for a more compact version of the switch than the rough version shown in the photograph. It may then be housed in a neat metal box, and may also have an additional knob on the inside. This allows the system to be set up from inside on the way out.

Finally, having installed the system, make sure good use is made of it. Set it up every time the house is vacated, even if you only intend visiting the next-door neighbour for a few minutes. It should also be set up at night, because an experienced pilferer can enter and ransack a house without disturbing even a light sleeper. ■

PREDICTING TRANSISTOR FAILURE



At right, the console from which the tests were controlled and, at left, the ovens and other environmenal equipment. Data plotting and card punching equipment is at the rear. Manipulation of individual specimens was avoided during the experiments by mounting them in groups of 10 on multi-connection plugs.

Failures among certain transistor types can be predicted from measurements of leakage current before they are placed in service, according to a 3-year study conducted at the NBS Institute for Applied Technology (U.S. Department of Commerce). The application of screening procedures developed in this study to germanium-alloy transistors may increase the reliability of transistorised equipment, including weapon systems, communications systems, and space vehicle instrumentation.

The NBS study was carried out over a period of three years by George T. Conrad, Jr., and Donald C. Shook (shown in picture) using the technique of accelerated aging through exposure to modest elevated temperatures. They found that measurements of performance before and after six weeks at this aging enabled them to separate the transistors tested into two groups: Those likely to fail during the first several years of service and those unlikely to fail.

The transistor failure prediction study was comprised of two experiments, the first a statistical evaluation of changes in parameters occurring during accelerated aging simulating years of actual operation. Early changes in leakage current parameters were found to follow the same pattern for all transistors that would have failed within several years of normal use. A screening procedure was developed from these data and its effectiveness verified in a second experiment which also tested the usefulness of additional variations in aging conditions.

In the first experiment, groups of 40 2N396 germanium alloy transistors, which had met stringent military requirements, were subjected to an initial series of measurements and then each group was placed in a temperature-controlled chamber. Ambient temperatures and bias powers were selected to provide junction temperatures of 25, 55, 100, 145 and 200 deg. C. The transistors were removed for repeated measurement runs after 340 hours of aging and returned to the ovens. This was again done at 1,000 hours, 4,700 hours, and at intervals up to 20 kilohours of aging. The procedure for measuring transistor parameters was designed to minimise the effects of variation in measurement conditions and to make use of automatic data logging equipment.

Early increases in leakage current, among the parameters tested, were found to be consistently associated with the first transistors failing. The first three failures among the 160 specimens would be expected to occur within about four years of normal use, based on the approximation that the rate of deterioration doubles for every 10 deg. C. increase in junction temperature. Normal operation is taken to be 55 deg. C. The changes in leakage current during 1,000 hours of accelerated aging — the ratio of the current at 1,000 hours to the initial value were found to be the best indicator of failure during the first 4 to 10 years of projected actual use. (Furthermore, the change identified which junction would deteriorate more rapidly.)

A second experiment was performed to test the screening procedure obtained from the first experiment and to evaluate the relative effectiveness of two different methods of maintaining junction temperature. Forty of the same transistor type (2N396) used in the first experiment and forty R212 transistors from each of two manufacturers, all considered to be high reliability devices, were used in the second experiment. Results of the second experiment confirmed earlier findings regarding the usefulness of the leakage current screening procedure. ■

LOUDSPEAKER SYSTEMS FOR

In our series on guitar amplifier systems, and following last month's description of a "Fuzz Box," we have something to say, this month, about loudspeaker systems for electric guitars. The article outlines the broad requirements and discusses typically suitable loudspeakers on the Australian market and the types of enclosure which are recommended by their manufacturers.

By W. N. Williams

Those who have never had occasion to give much thought to the subject are as likely as not to equate loudspeaker systems for guitars with those used for electronic organs and ambitious hi-fi systems. In fact, the requirements for all three are quite distinct.

In the case of a hi-fi system, for reproducing disc or tape records, the emphasis is on satisfying (though not necessarily smooth) bass, extended treble response and a curve, in between, which is as free as possible from notably prominent or depressed areas. Minimal harmonic and intermodulation distortion is another basic requirement.

While the owners of domestic high fidelity reproducing systems have a reputation for liking loud volume, in fact their inclinations seldom pose any great hazard for the loudspeakers involved. Such systems are normally operated within the confines of a home and within the tolerance of occupants and neighbours. In addition, the average hi-fi enthusiast is usually solicitious of his prized loudspeakers and the first to notice if they show any sign of acoustic overload.

As much as anything, moderately large loudspeakers, used in the average high-fidelity music situation, perform well because they are only moderately stressed and, for the same reason, give many years of trouble-free service.

Loudspeaker systems used for electronic organs have to satisfy a quite different set of requirements. First and foremost, they must exhibit a bass response which is not merely "satisfying" but is actually smooth, particularly over the range of pedal notes. It is most disturbing to organist and audience alike, if certain notes in the pedal octave(s) stand out prominently above others; the organist has to put up with the effect, for there is little he can do in practice to counter it. Resonance effects in organ loudspeaker systems therefore either have to be strongly suppressed or else deliberately guided into some part of the frequency range where they will cause least embarrassment.

As far as treble response is concerned, the requirements for an organ loudspeaker are relatively modest. In fact, a loudspeaker which rolls off smoothly beyond 6- or 7HKz may be preferred for its "rounder," "more organ-like" tone and its reduced sensitivity to unwanted hiss and key-clicks.

The power handling capacity required of an organ loudspeaker system varies with the situation but organ amplifiers typically deliver from about 20 to 60 RMS watts. Remembering that organ installations are more usually permanent rather than portable, the tendency is to use large and/or multiple loudspeakers, generously baffled to obtain the requisite bass characteristics, and not too heavily stressed.

A basic reason for using organ loudspeakers well within their power handling capacity is to ensure a minimum of intermodulation distortion. This can become very evident in the sustained and complex chords which are possible on a modern electronic instrument and to audiences which, for the most part, are quiet and attentive.

Loudspeaker systems for electric guitars have to satisfy yet another set of requirements, the two most pressing ones probably being (1) Ability to produce a very high level of sound and (2) To be no more cumbersome than strictly necessary. In general, this means that the baffle systems for guitar loudspeakers are very much a compromise and that loudspeakers themselves are heavily stressed, with the result that bass response, distortion level and loudspeaker life expectancy all fall somewhat short of what is expected in either high fidelity or organ service.

Recent correspondence with the Rola Company serves to emphasise the problems involved. We quote:

"The development of suitable loudspeakers for a guitar system imposes certain unique problems on the design engineer and it was because of this that Rola developed the 'EG' or Electric Guitar series in both 12P and 12U models. A typical problem encountered with loudspeakers of this type is the rapid and severe rise in voice coil temperature. Guitar loudspeakers must be capable of operating

A 15-inch and a 12-inch loudspeaker representing a range manufactured by Lafayette Electronic Industries, of 85 Regatta Road, Fivedock, N.S.W. 2046. Depending on cone style and baffling, the power rating for the 12-inch unit ranges from 15 to 25 watts. For the 15-inch unit it ranges from 25 to 50 watts.

Three typical 12-inch loudspeakers currently being used by Australian guitar manufacturers, left to right: Philips AD-5200, Rola 12UEG and MSP 12UA15. The power which all such loudspeakers will handle at low frequencies depends largely on the enclosure in which they are mounted.

with voice coil temperatures of 200 degrees F. without loss of bonding. Extreme cone excursion causes extensive flexing of the voice coil pigtails and all Rola 'EG' series are equipped with a special tinsel braid material with high fatigue resistance.

"Viscous doping of the cone corrugations eliminates the danger of rim splitting and allows the combination of high compliance and maximum power handling. These and other features incorporated in these loudspeakers ensure long life under heavy-duty operating conditions.

"It is essential for optimum performance that the loudspeakers be enclosed in properly designed cabinets to ensure correct loading. Failure to do this can result in a substantial reduction in the amount of power the loudspeakers can handle without physical damage. Designs for suitable loudspeaker enclosures are available from Rola."

In recent years, guitarists' ideas of what constitutes a practical loudspeaker system have undergone considerable change and some of the systems in current use involve enclosures of one type or another, which are more easily carried by two men than one!

A proportion of these are open-backed or fitted with variously vented or slotted backs which actually impose very little air loading on the cones at low frequencies. Their users like them because the open back allows sound from the rear of the cone to bounce around the stage area, broadening the apparent source. They are successful only if the loudspeaker's "unloaded cone" rating is high enough to cope with the power involved and/or if the player keeps away from damagingly heavy bass chords. For the most part, guitar manufacturers are wary about selling such enclosures because of the potential abuse of the loudspeakers.

They much prefer to standardise on completely sealed or, at most, cautiously vented designs which do load the rear of the cones with a cushion of air. The problem is that, for all their size, such enclosures are usually quite limited in internal volume, relative to the total area of the cone(s) involved.

From the viewpoint of the loudspeaker manufacturer, this practical limitation in enclosure volume is something of a bonus, in that it leads fairly naturally to the use of fully sealed boxes, with a sufficiently small volume of air trapped behind the cone(s) to cushion them against the excesses of over-enthusiastic guitarists.

Most loudspeakers used by guitarists in conjunction with higher-powered amplifiers are of the heavy-duty 12-inch type, with fairly substantial cone, surround, and supporting spider and a natural low-frequency resonance in the vicinity of 50Hz. When placed in a sealed enclosure dimensions as typically recommended, the resonance rises to the region of 80Hz. Above this figure, the response is relatively flat; below it, the response falls at an effective rate of between 6 and 12dB per octave. These figures are strongly reminiscent of sealed "bookshelf" type enclosures but with the difference that many such guitar loudspeaker systems employ a minimum of internal damping. One consideration is that the amount of damping material required would be quite substantial but, more to the point, guitarists do not appear to be averse to a somewhat less damped bass characteristic and to colouration from "bounce" at other frequencies being audible through the paper cone.

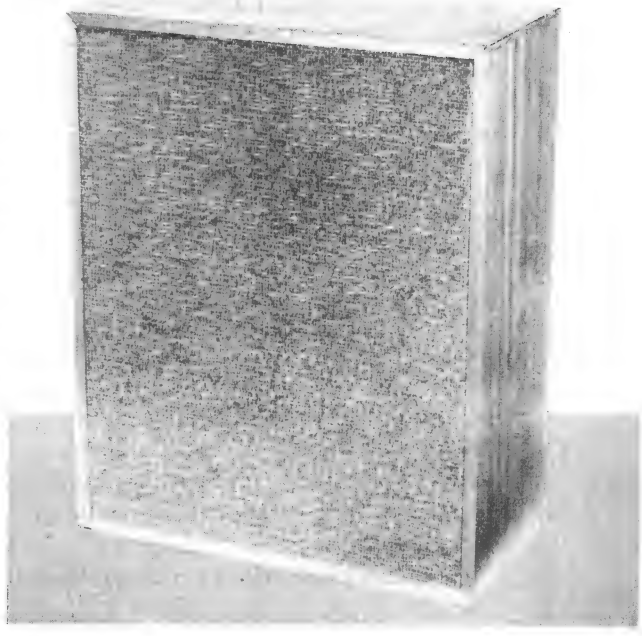


Figure 1: Sealed and filled in the manner of a "bookshelf" unit, this enclosure suggested by the Philips Miniwatt laboratory houses a single AD-5200 loudspeaker and is rated to handle up to 25 watts. Enclosure volume must not exceed 1.4 cubic feet for one loudspeaker, 2.8 cubic feet for two loudspeakers and so on. Such enclosures must be quite rigid and absolutely air-tight.

In fact, for lead and rhythm guitars, in particular, this kind of bass curve is quite practical. The lowest open string on the instrument produces a frequency of about 70Hz, which is not all that far from the nominal bass roll-off point. Furthermore, unlike an organist, a guitar player can control the amplitude of each individual note by the way he plucks the relevant string. In fact, he may even relish a bit of boom over the lower frets!

Bass guitars pose an additional problem in that they have an extra octave extending to about 35Hz and involve proportionately greater cone excursion for a suitably high level of sound. However, for practical reasons, bass guitarists often have to be satisfied with the same general class of loudspeaker system as other players and with developing high acoustic output by heavily driving loudspeakers in sealed enclosures at frequencies below the natural system resonance. Here again, the general thinking runs a close parallel to "bookshelf" techniques where output at the lowest frequencies is deliberately augmented by the use of bass boost. Naturally, this technique increases the stress on the loudspeakers and bass guitarists often have to "go easy" or put up with reduced loudspeaker life or discover, the hard way, those makes and models which will stand up to the punishment better than others.

Not surprisingly, this situation has focused considerable attention on the use of larger loudspeakers for bass service—15in and upwards—or loudspeakers with moulded plastic cones, very large and/or vented enclosures and so on. Such techniques can pay dividends in terms of louder and more trouble-free bass but they may also involve much higher initial expense and enclosures which are even less conveniently transportable than the more usual variety.

At the other end of the range, guitar loudspeakers and organ loudspeakers have a good deal in common. An upper limit of 5 to 6KHz will satisfy most players, though some may like the extra bit of "edge" which a twin-cone loudspeaker can give.

In terms of intermodulation and harmonic distortion, the requirements of guitar loudspeaker systems are not as stringent as those for organs. Chords, on the whole, are less complex, audiences less attentive to the finer points of sound reproduction and more responsive to sound that gains sonic impact by an abundance of lower order overtones. In fact, "Fuzz Boxes," as described last month, are expressly designed to generate distortion in a particular way and it is not unknown for guitarists to be rather partial to a an amplifier or loudspeaker system, which can contribute a degree of "free" fuzz by running into non-linearity at a convenient level.

The point in saying all this is not to suggest that frequency response and distortion level does not matter in a guitar loudspeaker system. Rather is it to stress that the standards by which their performance must be judged are those which apply for guitars—not for organs or high-fidelity systems!

Loudspeakers which are currently being used in Australian-made guitar systems include the Philips AD-5200, the MSP 12UA15 and 12PQ and the Rola 12PEG and 12UEG—all of these being 12-inch heavy-duty types. Also brought to our notice were some relatively new loudspeakers manufactured by Lafayette Electronic Industries of Sydney, who have a range of 12- and 15-inch loudspeakers suitable for guitar and organ

service. Again, distributors for overseas manufacturers have in their catalogues, loudspeakers which are strongly favoured by some guitarists.

It would be a monumental task to list and test all the loudspeakers which might conceivably be considered for guitar service and to relate their likely performance and limitations in the kind of enclosures which are typically in use. Instead, we have chosen to make particular mention of three typical loudspeaker systems, with the idea that these can serve as a guide to the form which such systems can take.

For their AD-5200 series loudspeaker, the Philips organisation suggests that it should be used in a completely sealed and airtight enclosure on the basis of not more than 40 litres of enclosure volume per 12-inch speaker (i.e. 2,440 cubic inches or 1.4 cubic feet). They further recommend that airspace in the enclosure be substantially occupied with a light filling (Innerbond, Tontine 75, etc.). Provided the box is rigidly constructed and absolutely airtight, they will rate the AD-5200 series loudspeaker to operate at 25 watts RMS, which is substantially above the power rating under other conditions of baffling.

Figure 1 shows the photograph of a single-loudspeaker enclosure constructed to these basic requirements. External dimensions are 20 x 16 x 8 inches and, allowing for half-inch timber, the nominal internal dimensions of 19 x 15 x 7 give an enclosure volume of 1995 cubic inches or 1.15 cubic feet. This is well under the maximum figure just quoted and gives a system resonance of 95Hz, as compared with 45Hz for the speaker in free air. The Miniwatt Division of Philips Electrical Industries have tested the speaker under these conditions and consider it to be an entirely practical design for lead and rhythm guitars in particular.

However, as a single loudspeaker unit, it is capable of working only with an amplifier of 25 watts maximum output power and the system would need to be scaled up to cope with more powerful amplifiers. Two AD-5200 loudspeakers operating in parallel in an 80-litre (2.8 cu. ft.) sealed enclosure should cope with 50 watts and so on. An important point is that larger enclosures will need to be constructed from thicker material (normally 1-inch) to maintain the requisite rigidity, and the larger panels may need to be internally braced.

Proper arrangements will also need to be made in regard to impedance. The loudspeakers should ideally be connected in parallel and two AD-5200PM loudspeakers, each 15 ohms, connected in parallel, would give a total impedance of 7.5 ohms. Two AD-5200M loudspeakers, each 7 ohms, connected in parallel, would give a net impedance of 3.5 ohms. With three loudspeakers in parallel, 15-ohm (—PM) units would probably be preferred to give 5 ohms impedance—a rather odd value which could conceivably be fed from a 3.5-ohm or 7-ohm tapping on an amplifier, depending on which gave the best results. With four loudspeakers, it is generally most convenient to connect them in series-parallel to retain the same impedance as a single unit. Thus four 15-ohm loudspeakers connected in series-parallel, would give a nominal impedance of 15 ohms; likewise for other impedances.

It should be stressed that the performance figures quoted in connection with figure 1 are based primarily on the Philips AD-5200 loudspeaker and, while we would expect other comparable heavy-duty loudspeakers to behave in a similar manner, they may or may not have a comparable power rating. This would be up to their manufacturers to say.

Figure 2 is a photograph of a two-loudspeaker system currently being marketed by R. Moody and Co. Pty. Ltd. of 126 Bombay St, Lidcombe,

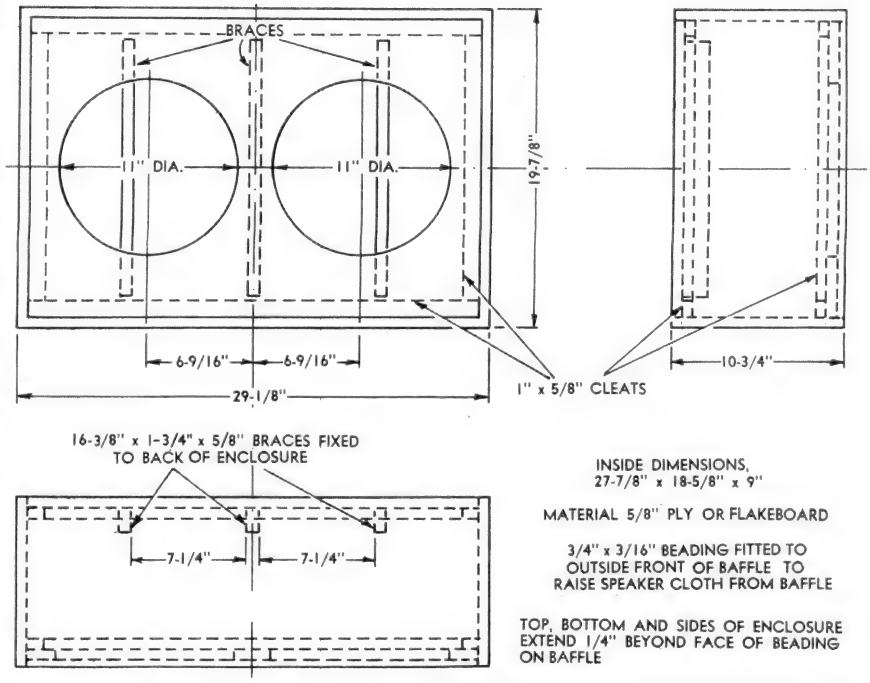
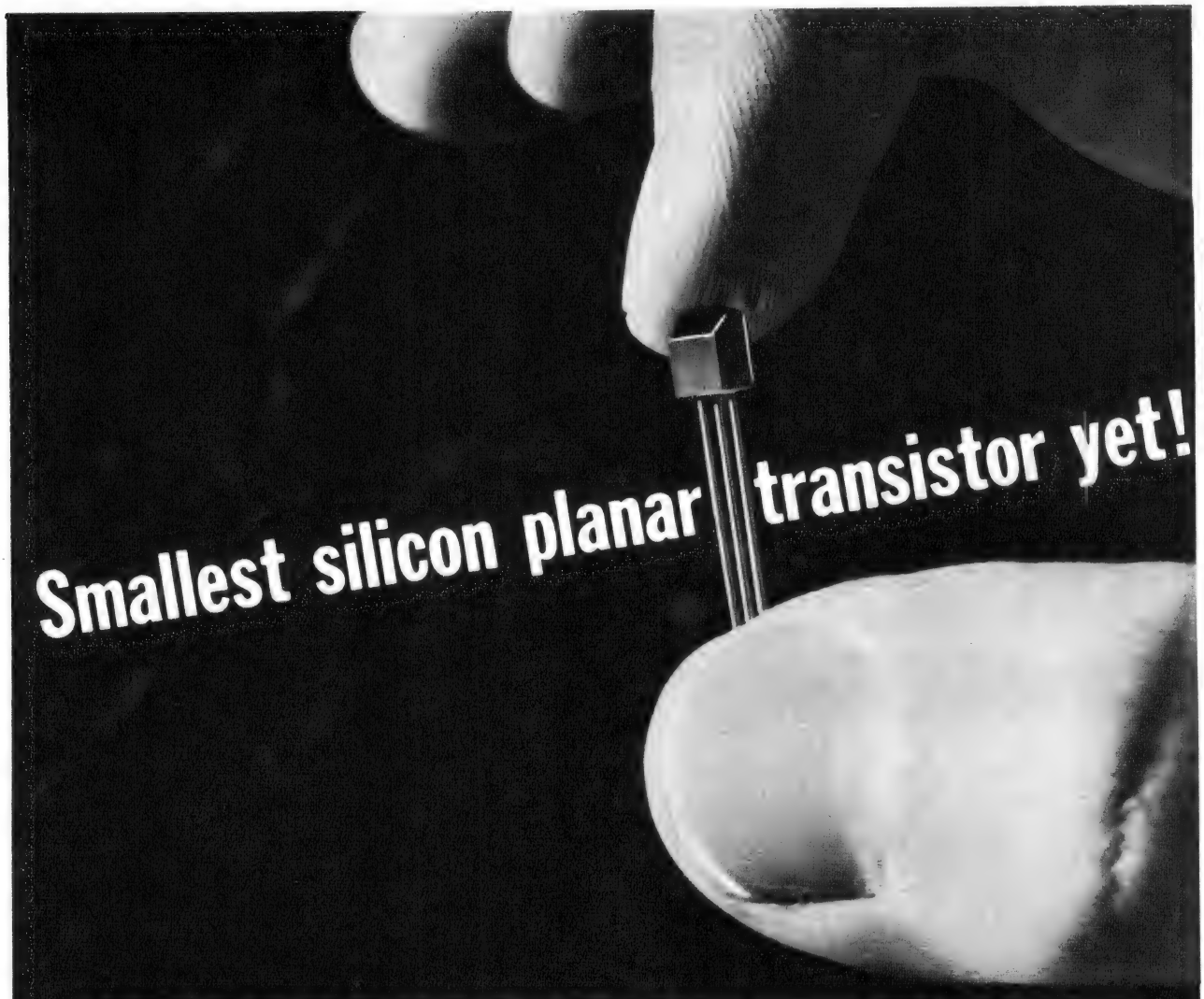


Figure 2: At left is a two-loudspeaker 40-watt enclosure marketed by R. Moody & Co. Pty. Ltd. The carrying handle normally rests against the case top, allowing a "piggy - back" amplifier to sit on top of it, without fouling. For home carpenters, the essential dimensions are shown above in figure 3.



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Notes relating to Table on right.

*N=NPN; P=PNP; PE=Planar Epitaxial; PL=Planar.
**Spot Noise Figures: 120Hz=5dB max.; 1.0KHz—3dB max.; 10KHz—2dB max.

Type	Structure*	BVCBO Volts	BVCEO Volts	BVEBO Volts	IC max. mA	hFE at min.	hFE at max.	IC mA	Prices Each 1-99	100-999	1000+
AT318 Gen. Purpose	N.PL	40	30	5	30	40	—	2	45c	30c	25c
AT319 Conv. I.F. Amp.	N.PL	40	30	5	30	40	160	2	46c	31c	26c
AT321 Conv. I.F. Amp.	N.PL	40	30	5	30	100	400	2	46c	31c	26c
AT322 Gen. Purpose	N.PL	35	20	5	30	40	—	2	42c	28c	24c
AT323 Conv. I.F. Amp.	N.PL	35	20	5	30	40	160	2	45c	30c	25c
AT324 Conv. I.F. Amp.	N.PL	35	20	5	30	100	400	2	45c	30c	25c
AT325 Low Noise R.F.	N.PL	35	20	5	30	20	180	2	48c	32c	27c
AT326 High Gain Audio	N.PE	30	25	6	30	60	300	1	53c	36c	30c
AT327 Ex High Gain Audio	N.PE	30	25	6	30	200	1000	1	53c	36c	30c
AT328 Low Noise Audio**	N.PE	30	25	6	30	200	1000	1	55c	37c	31c
AT329 Audio Output	N.PL	20	20	5	250	60	300	150	52c	35c	29c
AT330 High Gain Audio	N.PE	30	25	6	30	60	—	1	50c	33c	28c
AT331 Audio Output	P.PL	20	20	4	250	35	160	150	68c	45c	38c
AT335 Low Noise R.F.	N.PL	35	20	5	30	20	—	2	46c	31c	26c

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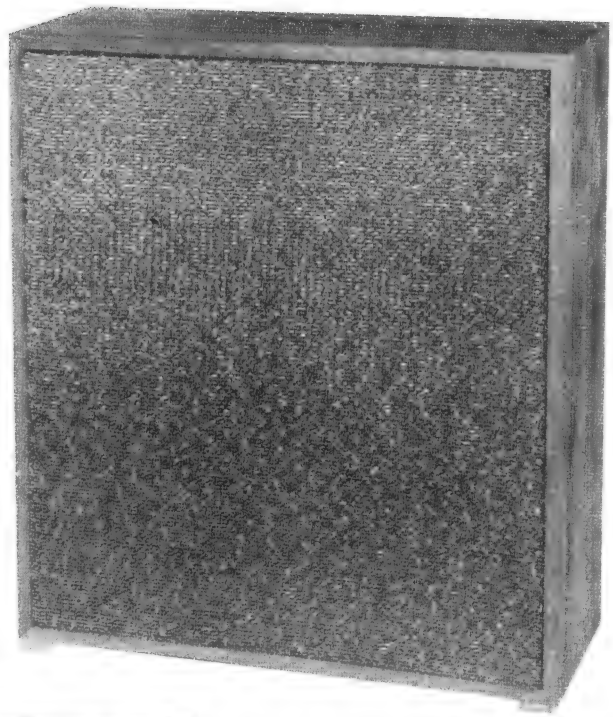
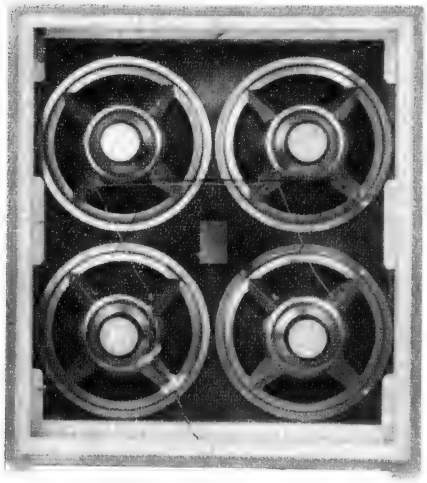


Figures 4 and 5: In terms of frontal dimensions, this design suggested by MSP engineers is about as small as it can be to house four 12-inch loudspeakers. It is intended to tilt back, supported by a rear, swing leg, to secure better projection offstage of middle and high frequencies and to expose a vent port on the underside. For practical guitar use, the enclosure would need to be fitted with protective corners and carrying handles.



N.S.W., 2141. It is constructed of flake board 5/8in thick, covered with good-quality plastic cloth and fitted with chrome-plated corners, rubber feet and tilt-back legs. It is available from the manufacturer with or without internal padding and with or without loudspeakers.

Fitted with MSP or Rola loudspeakers, the enclosure is normally sold by the Moody Company as a 40-watt system, recommended particularly for lead and rhythm guitars. However, its internal volume of 2.6 cubic feet would qualify it to take two Philips AD-5200 loudspeakers and would presumably gain the blessing of the Philips organisation as a 50-watt unit. In fact, we gather that this type of enclosure, fitted with the Philips loudspeakers, is finding some application with bass guitars and amplifiers of the 40-watt class.

For those who may wish to build their own enclosure along these general lines, figure 3 gives the essential dimensions. Note that it should be constructed from material not less than 5/8in thick and that all joints should be accurately finished, then glued and screwed as necessary. The rear lid must also make a virtually airtight fit and be fastened in place with at least four screws along each of the longer edges and three screws at the ends. The original design provides for the fret cloth to be supported in front of the actual face of the baffle to minimise the risk of it flapping under the influence of large low-frequency cone excursion.

Pictured in figures 4 and 5 is a prototype enclosure which has been developed by Manufacturers Special Products to mount four twelve-inch loudspeakers. As shown, it contains four 12UA15 units and is rated to handle 60 watts as, for example, from our Playmaster 117 Guitar Amplifier. For heavier duty service or for use with bass guitars, the company suggests a particular version of the MSP type 12PQ (part no. 50226) rated at 20 watts per loudspeaker.

Of particular interest is the fact that the MSP enclosure design provides for a small vent in one surface which would normally be placed so that it is at the bottom, and exposed by tilting the enclosure backwards. The idea behind this is that tilting the enclosure will get the middle and upper frequencies out over the audience and away from people, furnishings and carpets. Having a vent feeding into a V-slot formed by the bottom of the cabinet and the floor is presumably intended to improve bass efficiency somewhat, as compared with a conventionally vented or a non-vented enclosure of the same general size.

The design provides for an internal volume of about 3.5 cubic feet, which is considerably short of the figures quoted earlier as being adequate for a sealed enclosure. It would therefore appear that MSP engineers have tried to come up with the smallest practical enclosure which would house four 12-inch loudspeakers, resorting to a vent in an effort to offset the very limited internal volume. While the presence of the vent will remove some of the protection from the cones at very low frequencies, they should not be unduly distressed, provided the 60-watt rating is observed. One would expect other comparable loudspeakers to perform in a similar manner to the 12UA15 units and this would include the Philips AD-2000 series; Philips have emphasised

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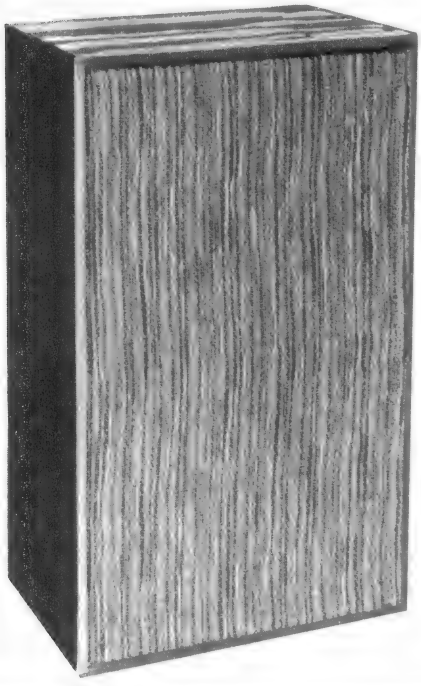

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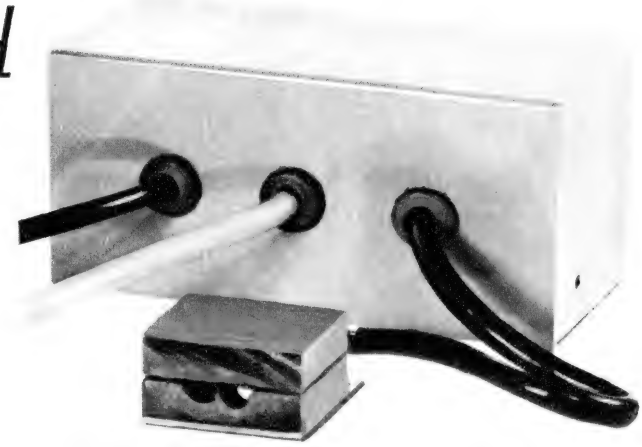

The complete relay unit and sensing head. Although this prototype shows all cables emerging from one side, this may be varied to suit individual requirements.

By Philip Watson and John Horsfield

The combination of a slide projector and a tape recorder is a very useful one, whether it be used for education, advertising, or simply home entertainment. It enables a program to be properly prepared well in advance. Careful thought can be given to the slides to be presented, for how long each will be presented, and what will be said about each.

A commentary can be prepared and recorded, with facilities to erase mistakes or remake those portions which, on reflection, one feels could have been better said. The end result should be a smooth, entertaining, and informative commentary accompanied by an equally smooth presentation of slides, timed, where necessary, to give just the impact the narrator intended.

At least, that's how it should be. In practice, it doesn't always work out that way, and one of the biggest problems is to ensure that each slide is present at exactly the right moment, particularly where the person in charge of the projector may be a complete stranger to the program. How can such a person be instructed precisely when to change each slide?

Probably the simplest method is to record the instructions along with the commentary, but continual repetition of "next slide, please," becomes awfully monotonous after a while, plus the fact that it breaks the continuity of the commentary and spoils the spontaneity which is possible when a slide can be presented unannounced.

Audible tones superimposed on the commentary overcome some of these problems, but still leave a lot to be desired. Cue sheets can, in theory at least, result in a better presentation as far as the audience is concerned, but put a heavy responsibility on the projectionists, who may not always be working under ideal conditions of lighting, etc.

The increasing popularity of the automatic projector, capable of changing slides at the touch of a button, prompted the idea that it should be possible to trigger the slide changing function in some manner from cues on the tape. Such a system would permit almost completely automatic presentation of a slide show. The only question is, what form can these cues take?

Several methods have been developed. One system uses low frequency tones recorded on the tape which, during replay, are separated from the commentary by filters and used to trigger the projector. Another uses strips of metallic tape stuck to the recording tape which are sensed by electrical contacts. A third provides visible marks on the tape which can be sensed by a photo-cell. For the moment we are concerned with the optical system, although we may investigate the low frequency tone system later on.

An advantage of the optical system, as described here, is that it is relatively easy to change the position of the cue marks, to achieve the precise timing required, without disturbing the recording on the tape. The same may not be true where sub-audible tones are used, since a misplaced cue mark could only be erased by erasing the commentary as well, necessitating complex re-recording to restore it.

Although designed primarily as a slide cueing device this system — or the alternative ones for that matter — can be used for a number of other functions. For example; even where an automatic projector is not available it can be used to energise a cue light near the projector to indicate to the projectionist when to change each slide. It can also be used as an automatic stop cue near the end of a tape to prevent the tape running off the reel and necessitating rethreading. A variation on this theme is to use it to mark the end of each item on a tape, thus simplifying the selection of a particular item.

The idea for the present design came from an article by the B.B.C. which appeared in "Wireless World" for July, 1958, and was reprinted in "Radio Television and Hobbies" for July, 1962. In fact, the idea of optical cueing is now well established. It is used extensively in radio and TV studios to mark wanted sections of audio and video tape and to actuate changeover devices from an outgoing reel of tape or film. Almost equally popular in this role is the system using electrical contacts.

For this reason, tape manufacturers have developed various "sensing" tapes, using pressure sensitive adhesives, which may be fastened to a recording tape wherever it is desired to introduce a cue. One of these is the Minnesota Mining and Manufacturing Company's Aluminium Sensing Tape Type 51-7/32, which is both electrically conductive and optically reflective, thus making it suitable for both systems.

When we mentioned our experiments to the 3M company, they very kindly made available a sample of this tape, as well as several other tapes which, although not designed specifically for this purpose, appeared to have at least the optical properties we required. An advantage of these latter types is that they are a good deal cheaper than the type 51-7/32. Some are splicing tapes, which are normally supplied in several colours to assist in visually selecting tape splices. Others are decorative tapes, but all have been approved by the company for use on recording tapes, on the basis that the adhesive will not ooze or in other ways damage the tape.

A point which has to be considered when using an optical system is the risk that it may respond falsely to the white tape commonly used for splicing. If there is any risk of this it can be minimised by using black splicing tape which, initially, we imagined might be essential. As it turned out, the white splicing tape is a relatively poor reflector, due in part to the fact that it is translucent and tends to reveal the brown of the recording tape beneath it. As a result we experienced no difficulty in adjusting the sensitivity of the system so that it would respond only to the selected cueing tape.

Of the various tapes we tested, the Polyester Gold Tape, type 850, performed virtually as well as the type 51-7/32 and, being a good deal cheaper, would appear to be a logical choice for this application. However, it is unsuitable for use as an electrical sensing tape.

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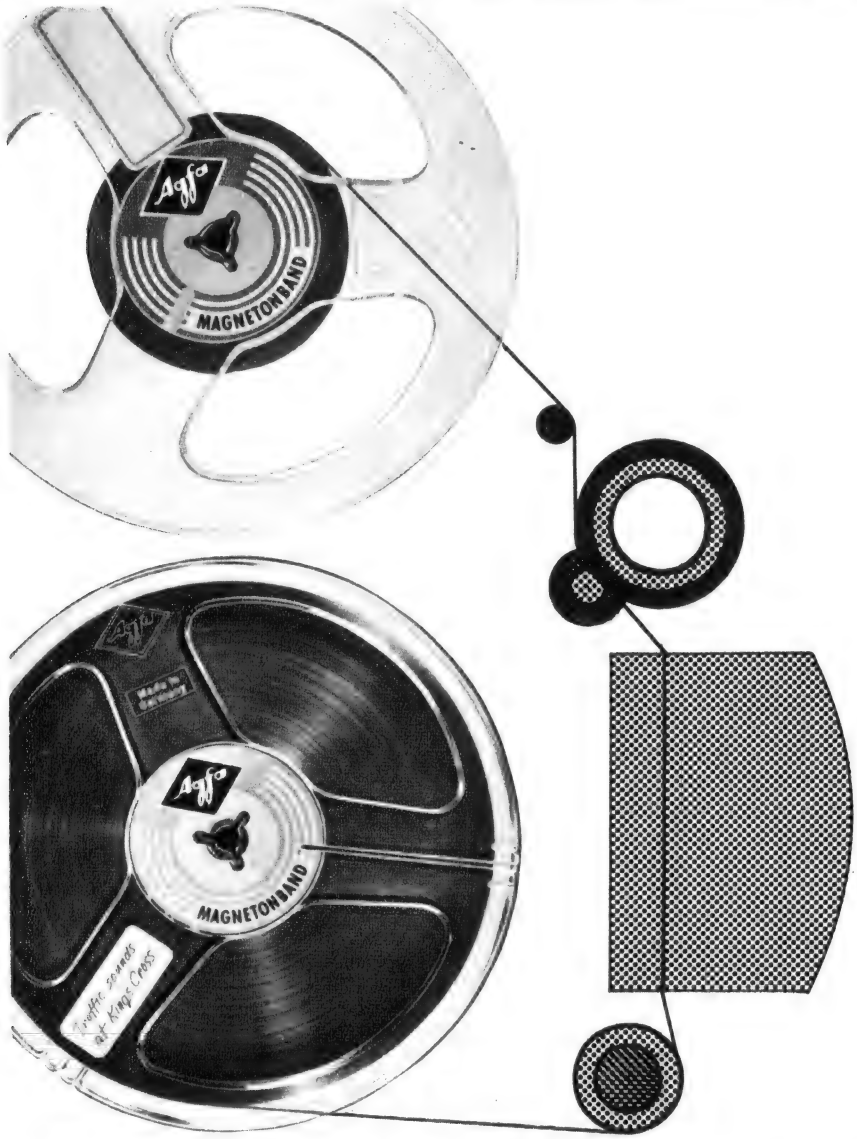

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This system requires an optical sensing head fitted to the tape recorder deck. This head provides both the light to illuminate the cue mark and the photocell to sense its presence. Since tape recorders vary a good deal in the layout of the deck, it is impossible to lay down hard and fast rules as to how large the head can be made, how it is to be mounted on the deck, or from what point in the tape transport system it should operate. The major requirement with regard to the latter is that it be located at some point where the distance between the head and the tape will not vary as the amount of tape on the spools varies, or for any other reason.

Consideration must also be given as to whether the head can be left permanently attached to the deck, whether it needs to be swung out of the way in order to thread the machine, or whether it is likely to foul any other function. These are things which only the reader can decide.

Another point was the likely variation in the types of projectors with which such a system could be used. In particular we were concerned with the time the trigger circuit would have to remain closed in order that the projector mechanism would lock itself into its own cycle, and also the orders of voltage and current which would have to be handled by any relay in the cueing device.

Preliminary investigations showed that most projectors required the slide change circuit to be held closed for a substantial fraction of a second to ensure that they would complete their cycle. Obviously, any cueing device would have to meet this requirement, either by extending the length of the cue mark, or by building a suitable delay time into the relay release function.

As regards the voltage and current such a relay would have to handle, it appears that most projectors are low voltage devices, working between 20 and 25 volts. A typical current value would be 1.5A but with a highly inductive load. These points are important when considering the type of relay and associated protective circuits required.

As a starting point for circuit design we considered that the most convenient way to operate a relay would be by means of a thyristor, possibly in conjunction with a suitably large capacitor across the relay to provide the hold-in time required by the projector.

For those not familiar with the thyristor, it may be regarded as the solid state equivalent of the old thermionic thyratron. It is a three terminal device, consisting of a cathode, anode, and gate. Basically it is a rectifier, but one which requires, in addition to the correct polarity between anode and cathode, a certain minimum gate/cathode current before it will conduct. When it does conduct, however, the gate control is lost and cannot be restored until the anode current is reduced to a very low value or the anode reverse biased.

To allow the gate to exercise virtually continuous control over the anode current it is normal practice to apply alternating or pulsed voltage between anode and cathode, thus allowing the gate condition to be "examined" once every cycle and for it to regain control during the cycle immediately following any change in the gate/cathode current condition. The use of AC for this purpose results in half wave pulses of current flowing through the device to be controlled — the relay in this case — but these are filtered by a capacitor connected across it. Such a capacitor, if large enough, can also be used to hold in the relay after current has ceased to flow through the thyristor.

The practical application of this idea is shown in the right hand portion of the finished circuit, involving the thyristor C106Y1, the relay, the 500uF capacitor across it, and the 6.3V AC supply. This latter value was chosen, incidentally, on the basis that it should be one which would be readily available from an existing piece of equipment, such as the tape recorder, or could be provided from a small and relatively inexpensive auxiliary transformer. It can also be used to power the lamp in the sensing head.

Initially, we imagined that it might be possible to control the thyristor directly from the sensing head, but a few experiments showed that, although results of some kind could be achieved, reliable performance was not possible within the other limitations of the system. Accordingly, we added an extra stage, a PNP transistor, between the sensing head and the thyristor.

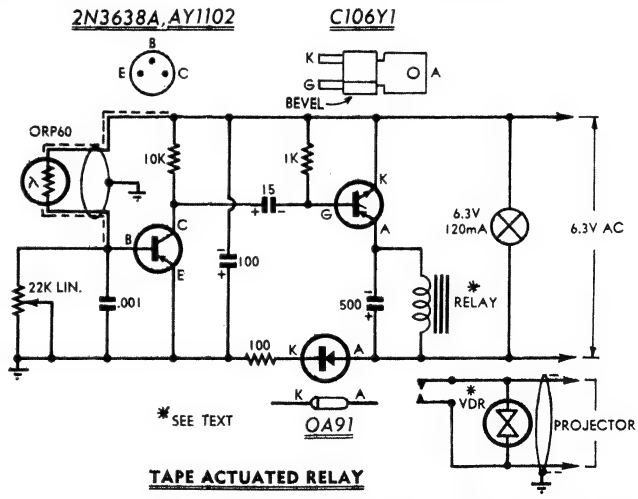
To provide the DC supply necessary for this transistor, a diode and smoothing capacitor are included in the circuit. The 100 ohm resistor limits the current through the diode to within its rating when the capacitor is charging or if there is an accidental short circuit.

The sensing head consists of a miniature indicator lamp and a photo-cell. The lamp is an imported (Japanese) type used in a miniature indicator bezel. It is a 6V 120mA type, and is about half the diameter of a conventional dial lamp. The one we bought cost 7c. The photocell is a Light Dependent Resistor (LDR) type ORP60. It is similar in size to the lamp.

The LDR, as its name implies, is simply a resistor whose value varies with the amount of light falling on it. In conditions of darkness its resistance is high, typically several megohms. Under bright light conditions it can fall to a few hundred ohms. In the circuit as shown it forms part of a voltage divider network in the base/emitter circuit of the transistor (2N3638A, etc.), the other portion being the 25K pot.

Under minimum light conditions the resistance of the LDR is high, resulting in minimum forward bias to the transistor base, and minimum current through the collector and associated 10K load resistor. When the LDR is illuminated its

The circuit is simple and uses few components. The thyristor conducts for each half cycle of the AC supply, if the gate is suitably biased. The LDR forms part of the bias network for the transistor, applying forward bias when energised by light reflected from the tape cue.



TAPE ACTUATED RELAY

LIST OF PARTS

1 Aluminium mini case 5in x 2¼in x 2¼in (or similar).
1 Wooden block for light head (see text).
1 6-volt, 120mA miniature lamp.
1 Relay (see text).
1 2-pin plug and socket (to connect unit to slide projector—see text).
1 Matrix board, ¼in spaced holes, 5 x 6 holes.
1 Matrix board, ¼in spaced holes, 8 x 19 holes.

SEMICONDUCTORS

1 Thyristor type C106Y1.
1 Transistor type 2N3638A, AY1102 or similar.
1 Diode type OA91, 1N60A or similar.
1 Light dependent resistor (LDR) type ORP60.
1 Voltage dependent resistor (VDR) type E299DD/P226 or E299DD/P228 (see text).

RESISTORS

(All ½ watt, 10 per cent.)
1 100 ohms.
1 1K.
1 10K.
1 22K pre-set potentiometer.

CAPACITORS

1 1000pF 25V
1 15uF 10V tantalum.
1 100uF 12V
1 500uF 16V (see text).

MISCELLANEOUS

Scotch pressure-sensitive tape No. 850 Polyester Gold, or similar (see text).
Shielded twin cable, two-pair cable (one pair screened), 3-core input power cable, wire, insulating sleeving, solder, nuts, bolts etc.

resistance drops and forward bias is applied to the transistor base. Current then flows in the collector and associated load circuit.

When the LDR is energised by light reflected from a small length of reflective tape, the result is a short duration rectangular pulse in the collector circuit of the transistor. The collector circuit is coupled to the gate of the thyristor via a 15uF capacitor which, in conjunction with the 1K resistor between gate and cathode, behaves as a differentiating circuit. The result is two short-duration spikes across the 1K resistor, one when the transistor goes into conduction and one when it goes out of conduction. The first spike only is of interest to us, as it is the correct polarity to trigger the thyristor.

It is desirable, in order to ensure that the capacitor across the relay is adequately charged, that the thyristor conduct for at least one quarter cycle, preferably longer. One full cycle at 50Hz is equal to 20 milliseconds (mS) and, since it cannot be predicted at which point in the cycle the triggering pulse will appear, it is necessary to ensure that the thyristor gate is held in a triggering condition for at least 15mS.

The differentiated spike applied to the gate can maintain sufficient amplitude for this length of time provided the transistor is held in conduction for this period. This means, in turn, that the cue mark on the tape must illuminate the LDR for this period as a minimum requirement. At 7.5in per sec. 15mS equals .1125in, or a little over 1/10in. In practice larger markers will probably be easier to handle. If there is any requirement that the cue marks operate during fast forward or rewind, the length of the cue mark will have to be increased proportionally, according to the maximum speed of the tape during these functions.

The variable 22K pot in the base circuit of the transistor serves as a sensitivity control. It should be set so that the system does not respond to reflection from the recording or splicing tape, but responds reliably to the cue mark. If this adjustment should prove unduly critical, it would be better to replace the pot with a smaller pot, say 5K, in conjunction with a value of fixed resistance selected experimentally.

An important point to be considered is the highly inductive nature of the load across the relay contacts. This can have two undesirable effects; one predictable and one which we had not anticipated. The predictable one was arcing across the relay contacts and we anticipated that we would have to adopt one of the normally accepted procedures to minimise this.

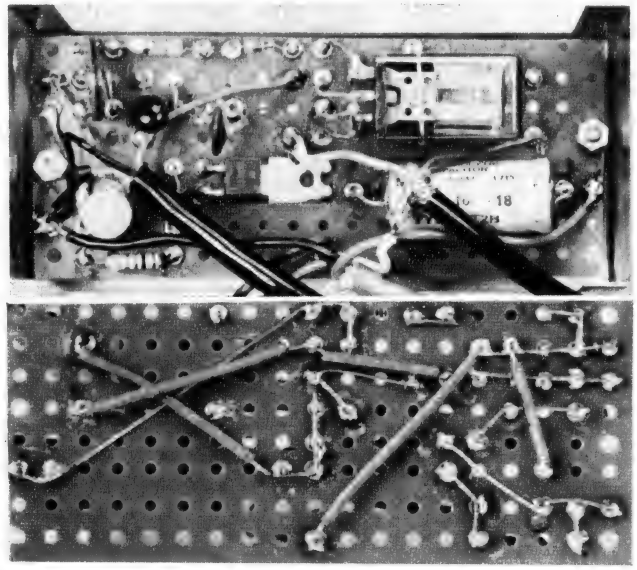
The unanticipated one showed up during a preliminary test of the system in conjunction with a projector and while suppression across the contacts had still to be optimised. It took the form of false triggering of the system, due to an interference pulse caused by the collapsing magnetic field around the leads from the projector to the relay, when the latter opened. The result was a double (or multiple) change from one cue mark.

Steps to overcome this involved optimising the suppression across the contacts, and shielding both sets of leads from the unit; those to the sensing head and those to the projector. It may be that these latter two precautions are not strictly necessary, but we provided them as a precaution. At the very least we feel that it would be wise to shield the sensing head leads.

We also connected a .001uF capacitor from base to emitter on the transistor. This is intended to bypass any RF energy which presents itself to the input circuit, including any RF component in the interfering pulse from projector.

Suppression of voltage across the relay contacts is by means of another solid state device, the voltage dependent resistor (VDR). The VDR is a non-linear resistor which exhibits a high resistance when the voltage applied to it is below a certain figure, but a resistance which becomes progressively lower as the voltage exceeds this figure. By selecting a VDR with an operating voltage close to the working voltage across the relay contacts, it is possible to effectively restrict the amplitude of an inductive voltage produced when the contacts open.

As we mentioned earlier, the voltage which operates the clutch coil in automatic slide projectors and which appears



The layout is not critical, but this is a convenient arrangement. The relay and bypass capacitor are at the right, and the thyristor near the centre. The transistor is at top left. The 100uF filter capacitor at lower left. The underside of the board is shown in the lower picture, this being turned over left to right.

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at the relay contacts is usually of the order of 20 to 25 volts. With the lower voltage types, a VDR type E299DD/P226 provides the necessary protection, while a VDR type E299DD/P228 is needed for the higher voltage types. It is important to measure the voltage on any slide projector to be used with this device to ensure that much higher voltages are not being used.

The relay must have an operating voltage of six to eight, with a coil resistance of between 150 and 500 ohms. Its contacts must be capable of carrying the operating current of the slide projector or other associated apparatus.

The relay in our final design, and which is shown in the photographs, is an STC type 240AFO relay. It has an operating voltage of eight to 26 and a coil resistance of 430 ohms. The holding capacitor is 500uF.

We also tried a reed switch in the circuit, with satisfactory results. This was a Plessey type UD601CR with a bobbin type 802546. This latter has a 160 ohm winding and needs six volts to operate. Because of its much lower winding resistance, the parallel holding capacitor is increased to 1000uF.

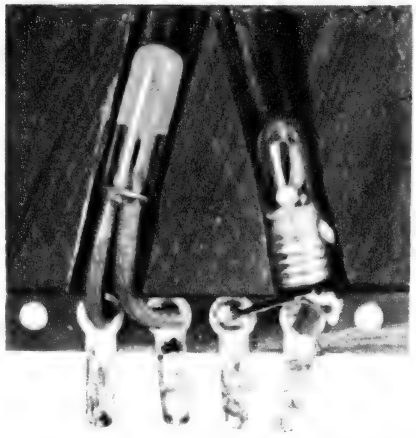
Another relay we tried was a P.M.G. type which had been used in an earlier project. It had a coil resistance of 200 ohms and, like the reed relay, needed a 1,000uF parallel capacitor. If other types of relay are used, the product of relay coil resistance and parallel capacitance should be made approximately equal to 200mS. However, this may have to be varied according to the projector requirements.

Our sensing head was made from two blocks of wood measuring 1¼in x 1in x 3/8in (approx.). These were made, in fact, from a single block approximately twice the thickness (¾in) sliced in two. In one half is cut two grooves in which are housed the lamp and LDR respectively. The photograph gives a good idea of this arrangement. The angle of the two grooves is such that lines through the lamp and LDR should coincide at a point about ¼in in front of the block, the latter being mounted this distance from the tape. The two channels and the surrounding surface of this block, and the mating face of the other block are painted matt black to minimise light leakage through the wood from lamp to cell, which can be surprisingly high.

Assuming that the channels have been accurately cut, it should be possible to remove and insert either the lamp or cell with the two halves of the block fastened together. Once this point is established the two halves may be glued together. To provide a terminal strip for the lamp and LDR, we glued a small square of matrix board, fitted with four terminals, to the underside of the block. This will require to be insulated, possibly with another piece of matrix board, if the block is to be mounted on a metal deck. Alternatively, the terminal board may be mounted on the top of the block.

Although the dimensions given will serve as a guide, the main requirement, apart from ensuring that it can be accommodated on the deck, is that the light illuminate only one half of the tape, normally the lower half. This is to permit two track operation by preventing the cues on one track from being sensed when the adjacent track is being played.

We considered whether it would be possible to extend this idea to cover four track operation, but concluded that it was not practical. Even assuming that the optical system could be suitably modified, and that the associated circuitry could be made sufficiently sensitive, we seriously doubt whether it would be practical to make and apply cue marks, as small as would be required, with the necessary degree of accuracy. However, where the four tracks were being used to provide stereo recording, the system would be a two track system as far as cueing was concerned.



The lower half of the sensing head, showing the LDR (left), the lamp, and the angle of the grooves.

The other components are mounted on a matrix board, the layout and underneath wiring of which are shown in the photographs. The layout has been planned to make it fairly easy for those readers who wish to prepare a printed wiring board. The matrix board is mounted on long bolts in an aluminium minibox. If a larger relay is used, it may have to be fitted under the matrix board with a suitable bracket.

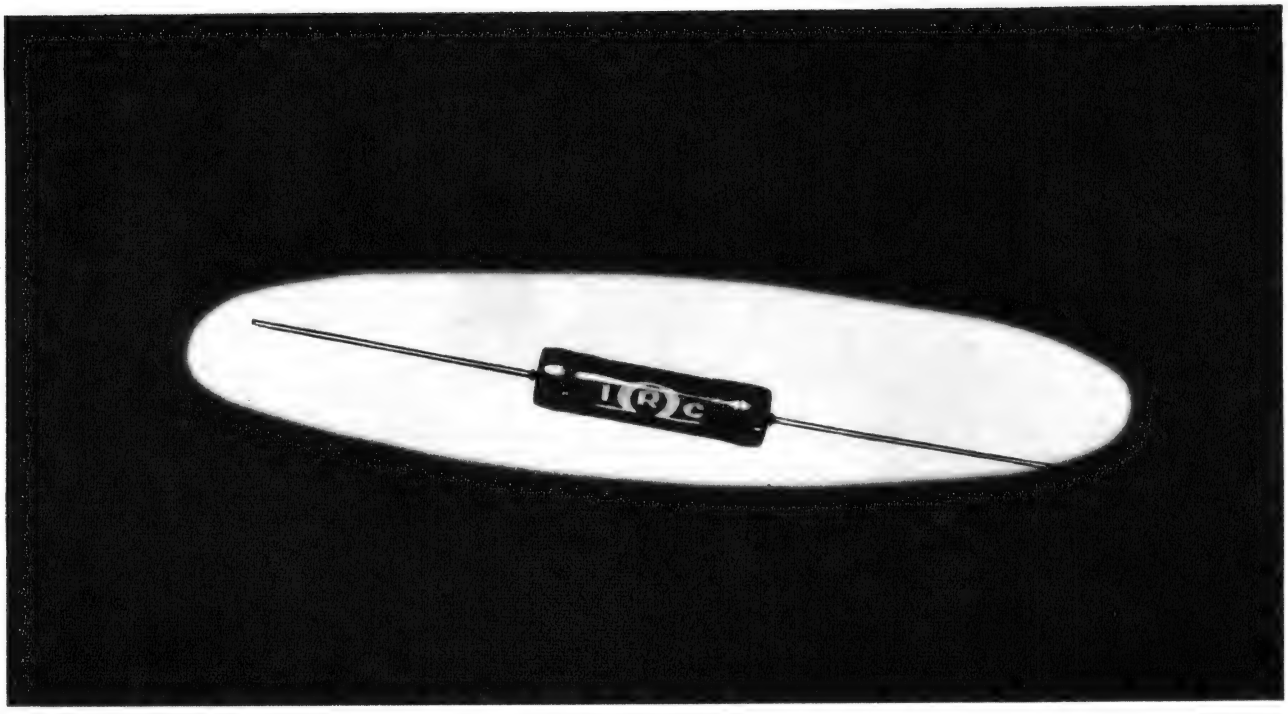
The method of connection to the control circuit of the projector will depend on the individual projector. It should not be difficult to trace the connections from the manual control button and to provide a parallel circuit from the most convenient terminal points inside the projector. This circuit can be terminated on a small two pin socket of some kind, mounted at convenient point on the frame of the projector. A matching plug is fitted to the relay cable from the cueing device.

The circuit, as shown, is intended simply as a cueing device. If it is required to perform some of the other functions suggested at the beginning of the article, such as stopping a tape machine at a cue mark, some modifications will be necessary. The main requirement is to make the relay "latch" into the new position and remain there until reset manually.

A number of possibilities suggest themselves, although we have not had an opportunity to try them. We offer them as ideas with which the individual may care to experiment. One is to use a relay with an extra set of contacts, these being used to switch a diode across the thyristor cathode to anode, when the relay closes. This will continue to conduct, and hold the relay in, after the thyristor gate is no longer triggered. An advantage of this idea is that it may be switched in or out, changing the system from the "cueing" to the "stopping" mode as required.

Another idea, more applicable where the device is be used only for stopping, is to operate it from a DC rather than an AC supply, with the upper rail (to the cathode of the thyristor) being negative. In these circumstances the thyristor, once it triggers, will remain conductive until the current through it is interrupted, as, for example, by a manually operated switch. With such an arrangement the 500uF and 100uF capacitors, the 100 ohm resistor, and the OA91 diode become redundant.

When used to stop a tape machine, the relay would be used to interrupt the supply to the tape motor(s) similar to the normal "stop" function on the machine. In this role the relay would require to have contacts and overall insulation designed to handle the voltages and currents involved. Protective circuitry for the relay contacts would also have to be selected to suit the conditions. ■



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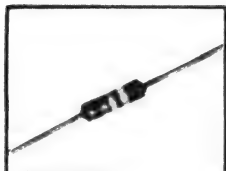

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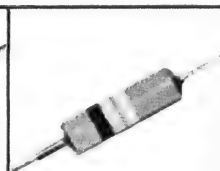

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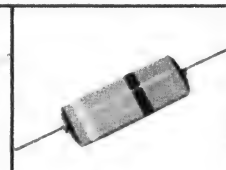

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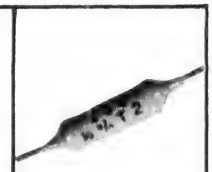

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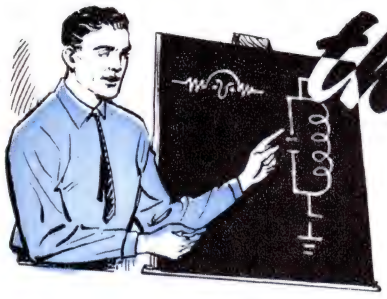


the "Answer Man" Explains

Will solid-state aerials supersede television arrays?

I saw reference in an overseas magazine to miniature solid-state aerials which will make present-day television aerials obsolete. Are these available in Australia? If they are not, when will they be?

We didn't see the reference ourselves but a reader rang at the time to tell us about it. We didn't commit all the details to memory but seem to recall that it was mentioned in one of the international weeklies.

As most articles and textbooks on the subject are at pains to point out, an aerial—or antenna—is most efficient for either receiving or transmitting, when it is of such dimensions that it is naturally resonant at the frequency concerned. At the lower frequencies, these dimensions, which are related to wavelength, are so large that they can be achieved only with considerable difficulty for transmitting purposes but are generally considered unpractical for receiving. At higher frequencies the dimensions become more manageable and the television antennae which "adorn" so many Australian homes are familiar examples of resonant style antennae. To be sure, their design and dimensions are a compromise, evolved in an attempt to cover a considerable range of frequencies, but they can be classed for our purposes as resonant.

It would obviously be an advantage if resonant antennae of all descriptions could be made smaller physically. They would be cheaper, lighter, less liable to wind damage, less conspicuous and so on. If one could guess what's in your mind, resonant television antennae might even be small enough to conceal within the cabinet of the television set, itself.

In fact, a lot of effort has been directed, through the years, at achieving smaller, resonant antennae. The coils which amateur station operators hang in their transmitting antennae, the circular framework atop some transmitting masts, and even the spiral portion of indoor television antennae are all aimed at shrinking the overall dimensions of a resonant antenna. Unfortunately, as a general rule, shrinking an antenna progressively reduces its efficiency, both for transmitting and receiving.

As far as receiving is concerned, the loss of efficiency may not matter overmuch, provided that the wanted signal is strong enough. However, if the wanted signal is at all weak, the use of an inefficient antenna only aggravates the problem of signal-to-noise ratio in the receiver, deteriorating the ultimate value of the received sound or picture.

A couple of years ago, at a symposium arranged by the Institution of Electronic and Radio Engineers, Professor H. H. Meinke described some research he was doing on behalf of the U.S. Airforce into what he called "active aerials." The basic idea was to associate an aerial, which one might assume to be smaller than optimum, with an active device such as a tunnel diode, high-frequency transistor or other device capable of amplifying incoming radio signals, while contributing a minimal amount of noise itself. By thus amplifying the signal before it encounters losses, which may be associated with the receiver transmission line and input circuit, some of the disadvantages associated with a diminished aerial might be offset.

This line of research has apparently been pursued in the months which have followed, some of it with a slightly different twist. By exploiting not only the low-noise characteristic of certain solid-state devices, but also their potential in wide frequency band amplifiers, research workers have come up with miniature "active aerials" which combine a quite useful order of signal pickup or sensitivity with an ability to operate over a wider band of frequencies than a conventional, passive resonant array.

It has been pointed out, however, that most of this work is aimed primarily at solving some of the problems which the use of larger arrays presents in certain military situations. Undoubtedly, some "fallout" will occur which will ease commercial problems as well, but this is not the prime concern at the moment, nor has anyone worried too much about their commercial economics.

As far as television reception is concerned, there is more to it than mere bandwidth and signal-to-noise ratio. One of the major reasons for using outdoor TV antennae is to get them away from the unstable environment of the viewing-room, with its people, furniture, blinds, etc., and out into the open, where signal patterns are less complicated and less variable. At the same time, the antenna can be orientated to best advantage in respect to ghost-producing objects.

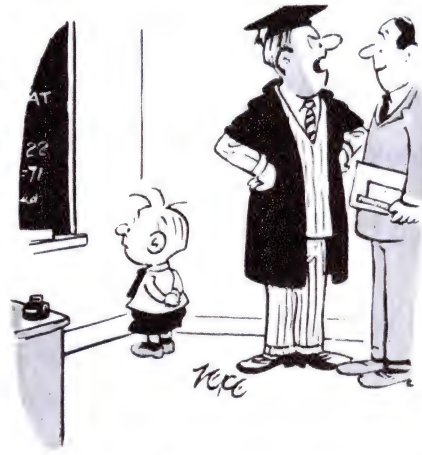
Fairly obviously, there would be little point in providing domestic television receivers with in-built antennae which suffer from all the signal-pickup limitations of present-day indoor antennae. There will be even more point to this observation, in a few years' time, when we are concerned with colour television signals, which are particularly critical as to antenna performance.

It may well be that the future for "active" television antennae will be as miniature outdoor units, supplied with power through the same down-lead by which they feed signals to the receiver.

When?

One of these days.

★ ★ ★



"I asked him who invented television and he said 'John Yogi Bear'." ("TV Times")

I have a 6-valve mains-operated radiogram and a 6-transistor portable. Even without an external aerial, the radiogram picks up more stations than the portable in daylight and the portable is even weaker when the batteries start to run down. Are valves more powerful than transistors and would the portable be better if driven off the power mains?

When a receiver is connected to the power mains, its behaviour in terms of ability to pick up signals is generally affected. By capacitive coupling through the wiring and power transformer, the mains may act as a kind of earth or counterpoise, complementing the function of any aerial which is connected to the receiver. If the aerial is non-existent or very short, the mains wiring may actually constitute a significant source of signal for the receiver.

Another point is that the performance of a receiver without an aerial is not conclusive evidence of its sensitivity. A

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sensitive receiver with short internal leads and a substantial order of shielding, by reason of chassis layout, may pick up only the strongest signals without an aerial. On the other hand, a less sensitive receiver, with longer and more exposed signal leads may actually pick up more signals than the other.

Because of these considerations, there is no great point in debating the performance of your radiogram without an external aerial. It obviously has the potential to pick up signals via its own wiring and its connection to the power mains. While this might be handy in some situations, the real value of the receiver, relative to more distant stations, can only be assessed by noting its performance with a suitable aerial connected and preferably an earth as well.

We assume that your transistor set will have a built-in loopstick aerial and, while these are a boon in terms of portability, their potential signal pickup is nothing like that of a normal outdoor aerial and earth. Notice that we said "and earth" because a normal battery-operated receiver derives only limited benefit from an external aerial without some kind of an earth return at the same time. "Some kind of an earth return" may be a true earth return to a water pipe or earth spike, a length of wire simply laid on the ground under the aerial or a connection to the power mains, where the receiver has provision for alternative mains operation.

And this has a bearing on a point raised in the initial question. Assuming that a mains-supply unit provided the same supply voltage to the receiver as a fresh battery, powering the receiver from the mains would not, in itself, make the receiver more powerful. It may affect its ability to pick up signals, by reason of the fact that the mains may act as a kind of earth or as a possible source of extra signal. However, with an external aerial connected and no earth, we would expect connection or otherwise to the mains to make a very big difference to signal pickup.

In short, there are so many secondary effects that it is pointless trying to draw conclusions about valve v. transistor receivers on the basis you have suggested. If comparison is to mean anything at all, it would have to be on the basis of trying both with the same external aerial and earth.

This would indicate the relative merits of the particular receivers concerned but it would not prove the general case, because your valve and transistor receivers may individually be good, bad or indifferent.

The most we would say is that a good 6-valve receiver, assuming that it includes an RF amplifier, would pick up most stations worth hearing, on an external aerial and an earth.

To give comparable performance with an external aerial and earth, not less than 6 transistors would be necessary, with possibly 7 for good measure. Beyond these figures, extra valves or extra transistors tend to yield diminishing benefits per unit.

★ ★ ★

What purpose is served by putting extra valves or extra transistors into receivers, over and above the usual number?

As noted above, a commendable order of performance can be obtained from a well designed receiver using 6 valves (usually 5 plus rectifier) or 6 (preferably 7) transistors. By adding extra valves or transistors with the appropriate back-up circuitry, it is possible to obtain better gain and selectivity characteristics from the IF channel, allowing the receiver to resolve difficult stations a little better. Additional valves or transistors may also be employed to operate a signal strength meter, or as a beat frequency oscillator to render Morse signals audible or to give better audio characteristics. The current series by Ian Pogson on all-wave receivers is a good illustration of how such facilities may be added.

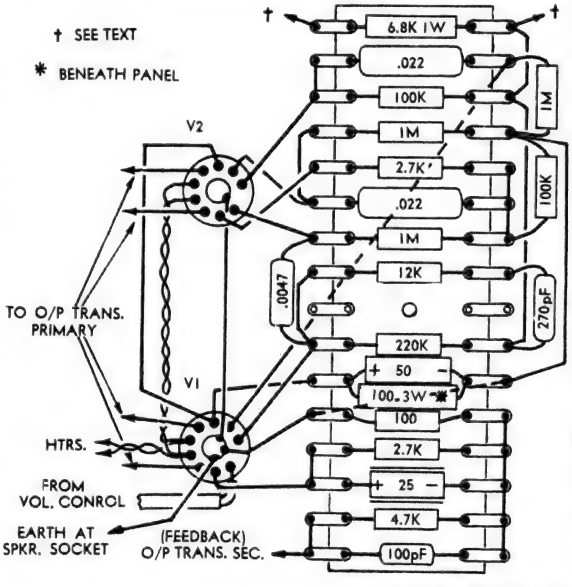
On the other hand, it is possible to add valves or transistors to a receiver which accomplish virtually nothing other than building up an impressive total. From recent references in American magazines, it would seem that some receivers on the U.S. market contain transistors which don't operate or, at best, serve as diodes. ■

Errata and Notes

1967 All-Wave Three, August 1967. Corrections to parts list: Delete the 7-pin valve socket; the number of 9-pin sockets should be increased to 3 and the number of BA100 diodes to 3.

Vari-Tach Motor Control, March 1966: The diode D2 marked as optional should be regarded as essential and should not be omitted.

Playmaster 118 Stereo Amplifier—July 1967: The wiring diagram of the power amplifier board on page 83 was in error. Constructors should assemble the board in accordance with the corrected diagram shown here. Corrections to parts list on page 85: 2 x 0.1uF/400 VW instead of 0.01uF; 4 x 25uF/6VW instead of 2 x 25uF/10VW and 2 x 50uF 6VW; 2 x 50uF/15VW instead of 2 x 50uF/50VW; 1 x 6.8K 1W instead of 2; 2 x 220K ½W resistors omitted. ■



A new line of simple superhets for home constructors —

The general appearance of the four valve version is similiar to the earlier one. The knobs for AM-SSB, BFO and S-Meter Zero are still not used. The S-Meter is not connected.

When wiring between the two mixers, keep all leads as short as possible. The two 15 ohm resistors should be wired right up to pins 1 & 7. Keep the OA91 and 100K close to the oscillator coil.

THE 1967 ALL-WAVE FOUR RECEIVER

Last month we expressed the hope that we would be able to follow the "67 All-Wave Three," with a double-conversion receiver, which we proposed to call the "67 All-Wave Four." The double conversion design has been successfully worked out and readers may add to the smaller unit or build this one as it is presented in the following pages.

By Ian Pogson

Unless they are very elaborate and expensive, all-wave superheterodyne receivers are more or less a compromise in design. The simpler they are, the greater is the compromise involved and this is brought out in the little "67 All-Wave Three," which we described last month. As only one frequency conversion process is used, the problem of image response becomes increasingly troublesome as the frequency of the wanted signal is increased.

This problem is solved by the double conversion technique, selecting a high value of intermediate frequency for the first conversion and converting again to the usual standard of 455KHz. We selected a first IF of 4MHz and, as there is little trouble with images below about 5MHz, we retained single conversion for the two bands covering the frequencies up to 5MHz. Above this frequency, double conversion is used.

Did we say something just a while ago about design being something of a compromise? Well, this arrangement does avoid image troubles but the double conversion process introduces a new, though much less troublesome, problem. The fixed local oscillator for the second conversion generates harmonics and these are tuned in on the receiver just the same as normal signals. It is also possible to get beats and other responses. This may look rather ominous but the spurious responses, as they are often called, can be minimised and made to fall in parts of the dial where they will not be much, if any, trouble.

We have taken steps to reduce them as much as possible but it must be remembered that we are producing a receiver which is neither unduly costly nor elaborate. To reduce the unwanted responses to a very low level would require elaborate shielding and filtering and would not be a practical proposition in a receiver of this type. Given a good aerial system, this little receiver will yield much enjoyment to the operator.

Much of the following text is a condensed version of last month's article, with the extra information added for the additional stage and components. If you have built the three-value version, then you will only be interested in the changes and additions. On the other hand, because of what follows, there is no real reason why you should have to refer to the earlier article to build the four-valve unit.

As we explained last month, the ultimate plan is to finish up with a receiver having six valves in all. Planned line-up is a 6BL8 first mixer and oscillator, a 6BE6 amplifier and converter, 2 x 6EH7 IF amplifiers, with back-to-back IF transformers, a 6BE6 product detector and BFO and a 6GW8 audio amplifier. An S-meter is also incorporated in the complete receiver. This is the plan and it is possible that there may be modifications in the process of development, but it will indicate the direction in which we are heading.

Having decided on the general plan, it was then decided to lay out a chassis and front panel to suit a six-valve receiver.

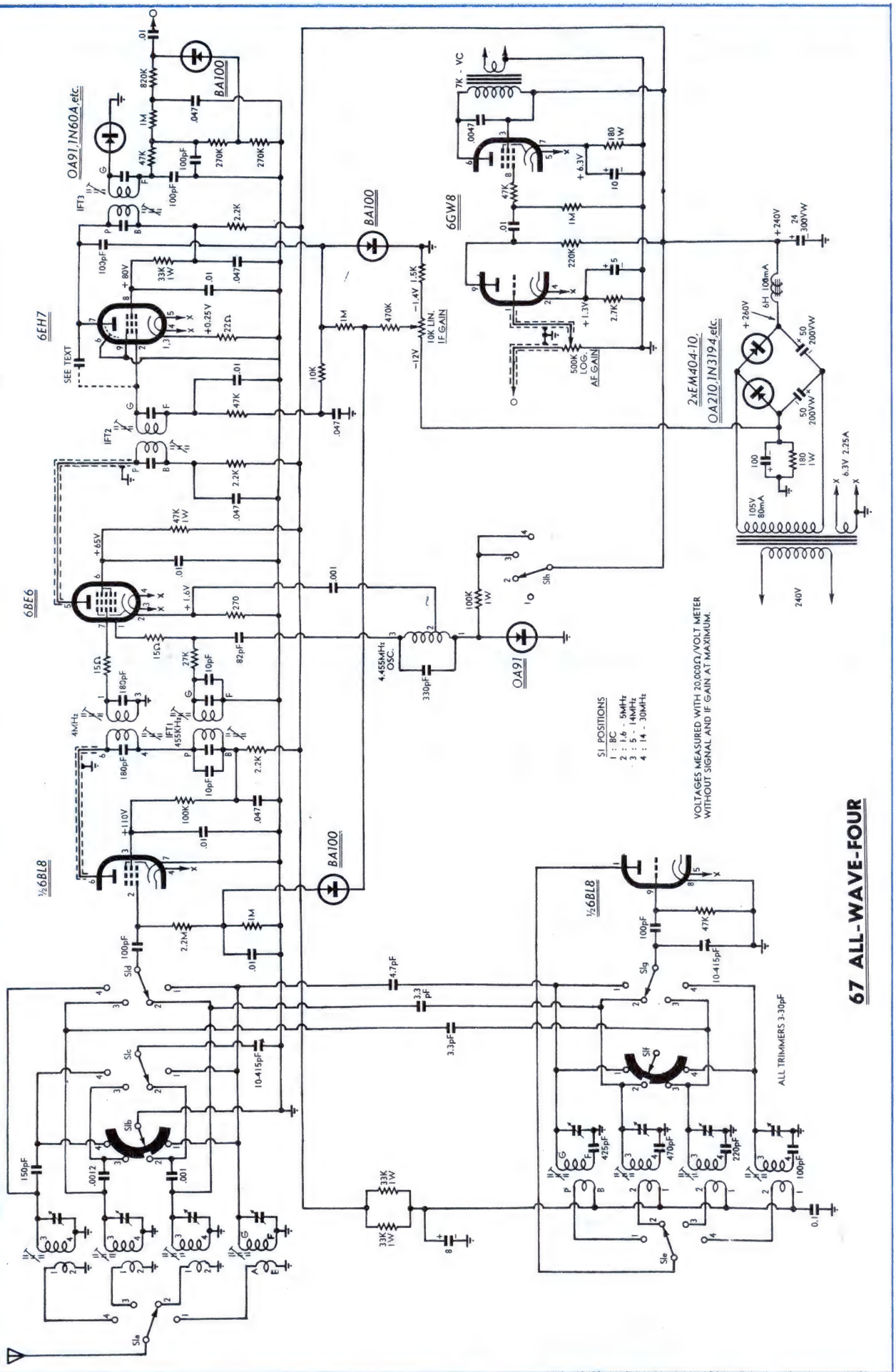
As will be apparent from the chassis photographs, the four-valve receiver is built on the chassis and front panel which will ultimately accommodate the six valve receiver, and this leaves a number of unused holes on the chassis and panel.

The reasoning behind this approach to a series of receivers, is that one may start off with the three valve version and add to it as time goes on. This can be done as required and it is virtually just a matter of adding the extra parts, with possible minor alterations to adapt to the new arrangement.

There is another advantage: The arrangement is so flexible that you may build up the receiver with the combination of facilities which may best suit your needs, leaving out any which you consider superfluous. For instance, if you are not interested in SSB reception, or Morse Code, you could leave out the product detector and BFO. On the other hand, you may wish to have an S-meter on only the four valve version. In short, you may "roll your own" just to your liking.

We can now turn our attention to the circuit of the four valve version. The first stage uses a 6BL8, the pentode section as the mixer, with the triode section for the local oscillator. There are four sets of switched coils, covering the range fully, from the broadcast band to 30MHz.

The mixer-oscillator converts the incoming signal to an IF of 455KHz for the two ranges up to 5MHz, and to an IF of 4MHz for the two ranges above 5MHz. The circuit shows two IF transformers, one each on 455KHz and 4MHz, between the 6BL8 pentode first mixer and the 6BE6 second converter. This arrangement will transfer either 455KHz or 4MHz, as required. The 6BE6 then functions as an amplifier or as a converter, for single and double conversion, respectively.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S1 POSITIONS
1 : BC
2 : 1.6 - 5MHz
3 : 5 - 14MHz
4 : 14 - 30MHz
ALL TRIMMERS 3-30pF
OA91,1N60A,etc.
BA100
6EH7
6BE6
½6BL8
6GW8
2xEM404-10,
OA210,1N3194,etc.
7K - VC
4.455MHz OSC.
SEE TEXT
105V 80mA
6.3V 2.25A
240V

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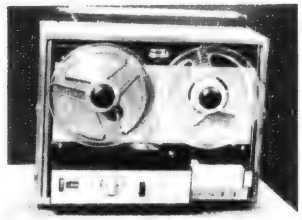

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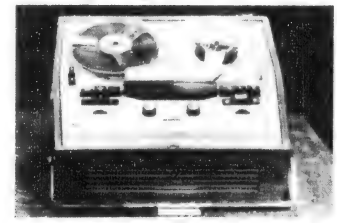

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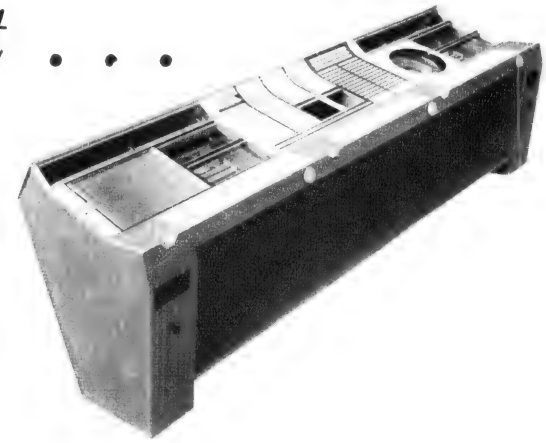

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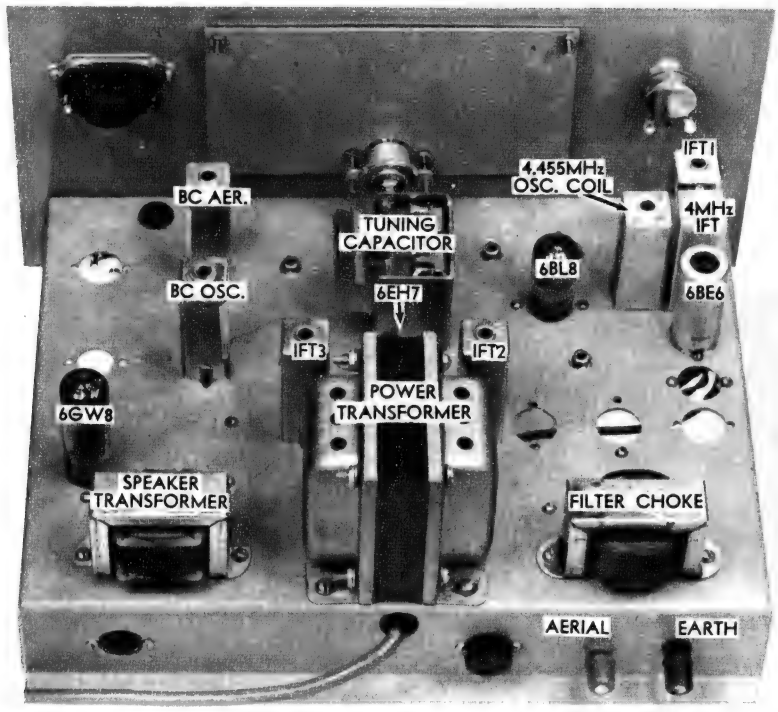


This is the layout as seen from the top of the chassis. Note the positions of the added major components, 6BE6 valve, 4.455MHz oscillator coil, 4MHz IF transformer and 455KHz IF transformer. Other components remain in the original positions.

The 6BE6 is followed by one 6EH7, 455KHz IF amplifier. The detector is an OA91, or similar diode. A series noise limiter is permanently incorporated in with the detector circuit.

The audio amplifier is quite conventional, using a 6GW8 triode pentode. The output transformer provides a 7000 ohm load to the output stage, when operating into the correct voice coil impedance.

AGC, derived from the plate of the 6EH7 IF amplifier, is fed back to the control grids of the 6EH7 and the 6BL8 pentode section. The RF gain control is closely associated with the AGC system.

The power supply is a voltage doubler type, followed by an inductance-capacitance filter. A "back bias" arrangement is provided for the RF gain control and its related circuits.

Perhaps one of the most difficult problems to solve in a full coverage receiver of this type, is the question as to what coils to use. Fortunately, Aegis Pty. Ltd., of Melbourne came up with a novel idea and which appeared to be worth investigating.

Basically, the idea is what could be called "instant short-wave coils." Three different sizes of coils are ready wound. The start of each winding is soldered to its terminating lug. More than enough turns are wound on the former and the two finishes are loosely terminated on the appropriate lugs. The idea is to wind off the turns which are not needed and then terminate the ends.

These basic coils can be modified so that they become an "aerial" coil, an "RF" coil, or an "oscillator" coil, according to the need at hand. The three sizes of coils have a graduated number of turns. This permits the use of the right basic coil for the frequency range to be covered and makes it possible to provide suitable coils for all functions that will cover from about 1.5MHz to 30MHz.

Physically, the coil assembly consists of several parts: (1) An inner tube, which is in fact a 7mm former, with a tuning slug, with a spire clip at one end for mounting to the chassis: (2) An outer polystyrene former, ¼in diameter and 1in long, which has the actual coils wound on it; (3) A collar, with four lugs for terminations, fitted to one end of the coil former. This collar in turn, is a push fit over the inner tube, resulting in a neat assembly. In the August issue of the magazine is an article which deals at some length with these coils and their application.

The coil switching involves the use of three switch banks. The bank at each end of the assembly is a 2-pole, 4-position, with a common shorting plate. The centre bank is a 2-pole, 4-position, without shorting plate. The bank nearest the clicker plate switches the primary and secondary of the aerial coils. The bank at the other end switches the primary and secondary of the oscillator coil. One pole at the centre bank is used as an auxiliary switch for the grid circuit of the aerial coil. The other pole switches the second conversion oscillator as required. A germanium diode, OA91 or similar, is used for the actual switching function. This avoids running long RF leads which were found to be responsible for numerous spurious responses. Responses due to this cause have been entirely eliminated.

The shorting plates are necessary to avoid coupling between coils, and degradation of performance. The shorting plate for the aerial coils is connected to earth, but the plate for the oscillator coils must be left floating, otherwise the oscillator HT supply would be shorted to earth. The auxiliary switching in the signal grid circuit is needed because capacitors are introduced in series with the tuning capacitor, on the short-wave bands to limit the coverage of each range.

Small capacitors of 3.3 and 4.7pF are used on all ranges except the highest frequency range. These are needed to give the right amount of oscillator injection. There is sufficient injection on the highest frequency range, via stray capacitance.

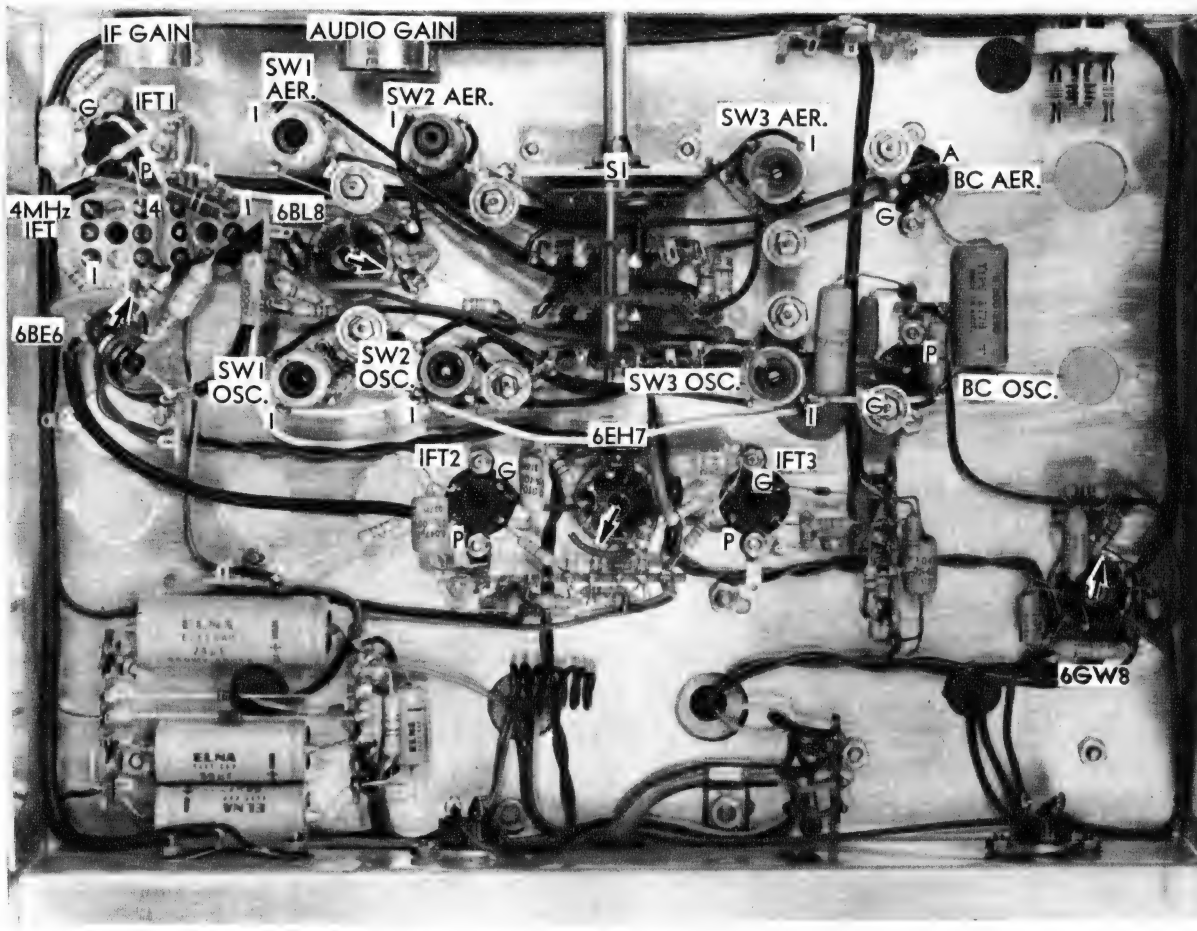
The pentode section of the 6BL8 is operated in a conventional manner as a mixer. It is a highly efficient mixer and is less noisy than the more conventional pentagrid mixers. This is important to us, as we are not using an RF stage.

The IF amplifier is relatively conventional. However, two points are worth noting. We have added a 22 ohm resistor in the cathode circuit, instead of connecting it directly to earth, as in the three valve version. This resistor gives some degenerative feedback and improves the AGC performance. Bias for the valve is fed into the AGC line. A small amount of positive feedback is used, from plate to grid. This is strictly controlled and is not enough to make the stage oscillate. By introducing a judicious amount of feedback, it is possible to increase the gain and improve the selectivity.

The feedback is shown as a dotted capacitor in the circuit diagram. The "capacitor" consists simply of a piece of hookup wire, about 1¼in long. One end of the wire is soldered to the plate lug of the socket. The wire is bent over the socket and "looks" at the grid lug. The wire is bent and moved close enough to the grid lug so that the requisite amount of feedback is obtained.

IF signal is taken from the plate of the IF amplifier and rectified for AGC. Taking the signal from the plate, rather than from the grid connection of the following IF transformer, gives a superior AGC characteristic.

The AGC voltage to the mixer grid



The disposition of the coils, trimmers and switch can be seen with relation to each other. The aerial coils are nearest the front skirt, with the oscillator coils near the centre. The highest frequency coils are to the right of the switch, with the next range on the other side. Note the second conversion components at top left.

is "gated" through a BA100 silicon diode. This is necessary to prevent any negative voltage, which appears on the mixer grid, as a result of oscillator injection, from being fed back into the AGC line.

The AGC load resistor is taken to the rotor of the IF gain control. One end of this control is taken to the —12 volts from the power supply. The other end of the gain control is connected to earth, via a 1.5K resistor. At the junction of this resistor and the gain control, is about —1.4 volts. With the control at maximum and the rotor at this end, this minimum voltage is fed into the AGC line as bias for the mixer and the IF amplifier. Moving the rotor of the IF gain control toward the other end feeds a higher negative voltage into the AGC line.

This type of gain control was used in the Deltahet receiver and it is very effective, particularly when an S-meter is used. It is possible to introduce a certain amount of manual control on a signal, without affecting the S-meter reading. More will be said about this in a later article.

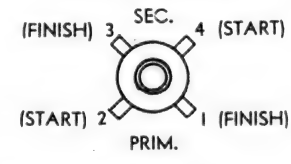
The power transformer which we used is an A and R, type 2062. This is rated at 80mA and has secondary voltage taps at 115 and 105 volts. We used the 105 volt tap, which gives the voltages as shown on the circuit.

The two 50uF voltage doubler capacitors which we used are only rated at 150 volts working. Using the 105 volt tap on the transformer, these capacitors are run just inside their ratings and the rating is quite in order.

An alternative is the Ferguson type PVD100. The secondary voltages on this transformer are 120, 110 and 100. Either the 100 volt or the 110 volt taps may be used. A word of caution is needed if you select the 110 volt tap. This will result in a voltage across the 50uF voltage doubler capacitors which exceeds 150 volts. Capacitors of a higher voltage rating, such as 200 volts working, will be required.

No doubt you will be wondering why

SHORT WAVE COIL TERMINATIONS
VIEWED FROM ABOVE



This diagram of the coil terminations should be carefully followed, in relation to the circuit. This applies particularly to the oscillator coils.

a transformer rated at 80mA has been specified, when the drain is well below this figure. Firstly, 80mA is the lowest rating of voltage doubler transformer which is readily available. Secondly, when extra valves are added extra current will be needed.

The filter choke specified is also capable of a higher current than necessary. Again, this is a small unit and is readily available. Before leaving the power supply, we have brought the heater and HT supply to a miniature 4-pin socket on the rear skirt of the chassis. This may be used for ancillary equipment, such as a converter.

Now we can turn our attention to the mechanical details. The photographs show clearly how the unit is constructed. The chassis measures 12in x 9in x 2in, with a front panel measuring 13in x 7in.

There are many vacant holes in the chassis, and we have deliberately left them that way. This highlights the space that has been provided for expansion into a larger version. On the other hand, we have filled up the holes on the front panel which are not being used at present. The holes referred to are for the AM-SSB switch, BFO adjustment, S-Meter and S-Meter Zero. This has been done to give an idea of the appearance of the full-size receiver.

The most vital part of the layout concerns the coils and the switch, in relation to each other and to other closely associated components. Cramping has been avoided and there should be no difficulty in duplicating the original.

The wave-change switch is mounted on a special bracket and it is fixed to the chassis with the same two screws which fix the front foot of the tuning

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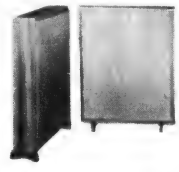
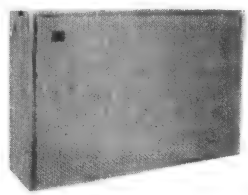
Model AS-40A. A miniature 2 speaker system 10⅜" x 7" x 6" with a wide frequency response. Special floating suspension in the bass speaker **$19.50**



Model AS-61. A slimline 5 speaker system with four bass/mid range units and a tweeter. Enclosures are only 4¼" deep — ideal for bookshelf installations. Will handle up to 20 watts music power. Size is 21¼" x 17¼" x 4⅛". Legs are detachable **$35.50**

Model AS-63. The AS-63 is a special bookshelf size speaker enclosure with a 6½" floating suspension woofer and a horn type H.F. unit. Although only 14¼" x 9⅞" x 8¼" reproduction is excellent. **$39.50**

Model AS-302. A 2 speaker system with a 12" woofer and a horn type tweeter. Will handle up to 20 watts music power. **$47**



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See and hear "Sonics" enclosures at Encel Stereo Centres in Sydney or Melbourne . . . they're exceptionally good value at these low Encel prices!

WHARFEDALE SPEAKERS

A complete range of world famous Wharfedale sound reproducers is always available at Encel Stereo Centres . . . write or call for an EMQ or a trade-in valuation. Models in stock include: Super 3, Super 5, Super 8 RS/DD, Super 10 RS/DD, Super 12 RS/DD, W12/FRS, W15/RS, PST/4, 8 in. Bronze RS/DD, 10 in. Bronze RS/DD, Golden 10 RS/DD and the RS 12/DD.

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This beautifully finished and functional universal tone arm lift will fit all tone arms . . . the lowering action is pneumatically dampened and extremely smooth. Risk of record damage may now be eliminated **$8.50**

IMPROVE STANDARDS WHEN RECORDING—DEMAGNETISE!

Two new tape head demagnetisers are now available . . . the single probe is Encel priced at $3.50 and the double probe only $3.00. Recording heads may be demagnetised in a few seconds and quality of recordings improved considerably. Essential for all tape enthusiasts.

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Power output is 35 watts R.M.S. with parallel push-pull 6BQ5's, frequency response is 30-15,000 Hz. plus or minus 2 dB. Three inputs-two crystal or dynamic microphones at 5 mV. and an auxiliary input for crystal or ceramic pick-ups, tape recorder or tuner at 300 mV. Output impedance includes 8, 16 and 250 ohms as well as a 70V line. Valve complement: 1 x 12AX7, 1 x 6AV6, 1 x 6AQ8, 4 x 6BQ5. Encel price is only **$73.50**

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The Nikka-Lustre tone arm Model C.P.3 is a beautifully engineered instrument which will track down to ¼ gram with suitable cartridges. An open-front head shell accepts all standard ½" mounting cartridges — and the arm takes Ortofon and SME shells without modification. Miniature ball races are used throughout — an outrigger bias adjustment sets stylus pressure. A tailored lifting/lowering device is now available for this arm ($7.50). See the review in "Electronics Australia", p. 123, October, 1966. Write for copies **$19**

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capacitor. With this arrangement, the hole in the bracket for the switch bush is off centre with respect to the bracket.

Care has been taken so that all major components will stay in their present positions, even when all the extra facilities and stages have been added.

Although the 6EH7 IF amplifier will remain in its present position, it will become the second IF amplifier. At the present time, there is a relatively long lead from the plate of the mixer, to the IF transformer which couples into the IF amplifier. This lead, which is shielded for stability reasons, will be considerably shortened later.

One vital part of the "mechanics" is the dial. We have adopted the same approach as for the SSB Transmitter. The main difference between the two dials is that this one is somewhat larger.

The basic movement is the planetary dual-ratio unit, made by Jackson Bros., and distributed in Australia by Messrs Watkin Wynne. A backing plate, 6 5/16in x 3¼in, was made from 16-gauge aluminium sheet.

The dial scale is the same size as the backing plate and we used a piece of Formica board, one face finished in matt white. All lines are drawn in, using drawing instruments and Indian ink. Photographic reproductions of the scale will be available through the Information Service, at 50c each. The alternative is to do the whole job yourself, along with the calibration, which will be discussed later.

Please note that the scale for the double conversion receiver is not the same as for the single conversion unit. Do not forget to specify which one you need when ordering. Obviously, when the single conversion receiver is changed to double conversion, a new dial scale will be required.

An escutcheon adds an appropriate finishing touch to the assembly and we made one up from another piece of 16-gauge aluminium. The outside dimensions are the same as the backing plate. The inside dimensions are 5 11/16 x 3 1/8in. These latter dimensions correspond with the cutout in the front panel, with four mounting holes also corresponding with holes in the front panel and backing plate. The escutcheon was given a coat of glossy black enamel.

So much for the dial assembly, except for the pointer. We got to work and made one out of a piece of 16-gauge copper wire. This is how we did it.

Take a piece of tinned copper wire, about 2½in long. This is hammered flat, leaving about ¾in still round at one end. This process calls for a little time and patience. A hammer with a good smooth face and a hard flat surface, such as part of a vyce, are the tools to begin with. Keep hammering, not too hard, until a reasonably flat surface is obtained on one side. Then turn the wire over and proceed to treat it in the same way. Do not worry overmuch if the flattened wire assumes the shape of a banana. This can be straightened as the job proceeds.

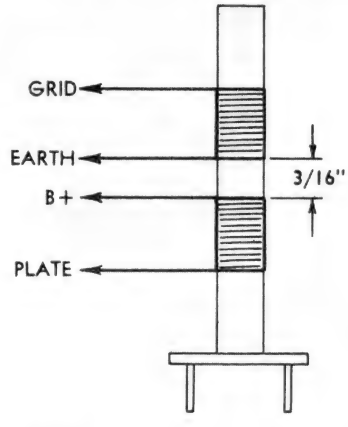
Having done what could reasonably be considered as a good job up to this point, there will be undulations due to uneven hammering. These are removed by carefully filing both flat faces. As this proceeds, careful inspection will dictate what should be done to make the finishing touches. When you are satisfied and the pointer is straight once again, solder the round end to a small solder lug and then give the pointer a coat of black paint. The hole in the lug is used to fix the pointer to the movement, with one of the two screws supplied.

Although we did not fit a sheet of perspex over the dial, some builders may prefer to do so. A piece may be cut to the same outside dimensions as the escutcheon. The perspex may then be interposed between the escutcheon and the front panel.

Assembly of the dial unit is quite simple but it is desirable to do it in a logical sequence. The movement is fixed to the back plate with two screws through the holes adjacent to the 13/16in hole. The lugs of the movement have to be spaced behind the back plate by about 9/16in. Suitable brass spacers can be used but this is not really necessary. We simply used brass screws, ¾in long. Six nuts are then used to give the right amount of spacing. This method has the advantage in that fine adjustments can be made to the spacing.

The backing plate is immediately between the scale and the distance between the scale face and the back of the panel will need to be between 1/8in and 3/16in, according to space desired between the pointer and scale. One nut used as a spacer may be just insufficient and two nuts may give too much spacing. A combination of one nut and one or more washers will give the desired spacing.

Push the four screws through the corners of the escutcheon and include the perspex if used. The screws are then passed through the corresponding



Winding details for the 4MHz IF transformer. Make sure that the windings are spaced and terminated as shown in this diagram.

PARTS LIST

1 Chassis, 12in x 9in x 2in.
1 Front Panel, 13in x 7in.
1 Cabinet to suit (if required).
1 Dual-ratio dial movement (see text for details).
1 Switch 2 wafers 2-pole 4-position with shorting plates, 1 wafer 2-pole 4-position.
1 Variable capacitor, 2-gang 10-415pF.
1 Power transformer, 105-110V 80mA, 6.3V 2.35A.
1 Speaker transformer 7K to voice coil.
1 Filter choke, 6H 100mA.
1 Coil, broadcast aerial.
1 Coil, broadcast oscillator.
1 Coil, 1.6-5MHz aerial (see text).
1 Coil, 1.6-5MHz oscillator (see text).
1 Coil 5-14MHz aerial (see text).
1 Coil, 5-14MHz oscillator (see text).
1 Coil, 14-30MHz aerial (see text).
1 Coil, 14-30MHz oscillator (see text).
3 IF transformers, 455KHz.
1 IF transformer, 4MHz.
1 Oscillator coil, 4.455MHz.
3 Valve sockets, 9-pin.
1 Valve socket, 7-pin (with shield).
1 Valve, 6BE6.
1 Valve, 6BL8.
1 Valve, 6EH7.
1 Valve, 6GW8.
1 Socket, 2-pin miniature.
1 Socket, 4-pin miniature.
2 Terminals, one red, one black.
1 Potentiometer, 500K log.
1 Potentiometer, 10K lin.
2 Diodes, EM404-10, OA210, 1N3194.
3 Diodes, BA100.
2 Diodes, OA91, 1N60A.
1 8-tag strip, with two mounting feet.
2 7-tag strips, with two mounting feet.
1 5-tag strip.
3 4-tag strips.
4 3-tag strips.
1 2-tag strip.
6 Knobs.

RESISTORS
(½W unless specified)

2	15 ohms.	4	47K
1	22 ohms.	1	47K 1W
2	180 ohms 1W.	1	100K
1	270 ohms.	1	100K 1W
1	1.5K.	1	220K
2	2.2K	1	820K
2	2.7K	4	1M
1	10K	1	2.2M
1	27K	2	270K
3	33K 1W	1	470K

CAPACITORS

2 3.3pF NPO ceramic.
1 4.7pF NPO ceramic.
2 10pF NPO ceramic.
1 82pF plastic.
6 100pF plastic.
1 150pF plastic.
2 180pF plastic.
1 220pF plastic.
2 330pF plastic.
1 425pF mica padder.
1 470pF plastic.
2 .001uF 160V plastic.
1 .0012uF 160V plastic.
1 .0047uF 400V plastic.
3 .01uF 160V plastic.
1 .01uF 400V plastic.
3 .01uF 400V ceramic.
2 .047uF 160V plastic.
3 .047uF 400V plastic.
1 0.1uF 400V plastic.
1 5uF 3VW electro.
1 8uF 300 VW electro.
1 10uF 12VW electro.
1 24uF 300VW electro.
2 50uF 200VW electros.

SUNDRIES

Power flex and plug, cable clamp, solder lugs, hookup wire, shielded cable, screws, nuts, solder, rubber grommets, etc.

holes in the front panel. Run a nut (with the washers) on to each screw. The nuts should not be tightened at this stage. Offer the back plate assembly over the four screws and tighten the nuts. Four more nuts behind the back plate hold the complete dial in place. Screw the pointer to the movement.

The dial which results is one which is capable of smooth and fine control over tuning. This can be even improved upon by the simple expedient of using a very large knob, which helps the vernier action.

Before proceeding with the general assembly, it would be a good idea to get the short-wave aerial and oscillator coils ready. We will assume that you have two each of the Aegis types RFT2, RFT5 and RFT10. All the information needed is given in the coil table.

The process is quite easy but just a few pointers may be helpful. When removing turns, particularly with the fine wire, care should be taken to do it gently, to avoid breaking the wire. When the requisite number of turns have been removed, cut off the excess wire and terminate the end by soldering to the appropriate lug. In most cases, there will be sufficient sealing compound on the windings to hold the wire in place. In the case of the RFT10 coils, it is wise to put a dab of cellulose or other adhesive on the coil, to prevent unwinding and general movement of the turns. A diagram shows the terminations which are numbered and this correlates with the circuit diagram.

We understand that Aegis Pty. Ltd. and possibly other manufacturers will be making a 4MHz IF transformer and 4.455MHz oscillator coil, available. For builders who wish to make their own, details are given in the table of coil information.

By tackling the assembly in some logical order, the job is made easier and quicker. The valve sockets should be orientated with the gap pointing in the direction as shown on the underneath picture.

Mount the tuning gang, together with the switch bracket. Then follow the broadcast aerial and oscillator coils and the IF transformers. Fit the two sockets and two terminals to the back skirt of the chassis. Mount the power transformer, output transformer and filter choke.

The short-wave coils are about all that are left at this stage. They should be carefully placed in the positions as indicated in the picture and with due regard to short leads. The coils are held to the chassis with spire clips; if the metal is too thick to take them, it may be necessary to countersink the holes slightly at the top of the chassis. The countersink should only be deep enough to allow the clip to spring into place.

The components should now be mounted on the front panel, the controls being used to fix the panel to the chassis. If you do not fit the AM-SSB switch and the BFO control, it would be wise to fit at least one bush or a dummy control in either of the vacant holes.

The job of wiring is tackled in the usual way. Terminate the flying leads from the transformers and the filter choke. You will notice in the picture of the under-chassis wiring, that there is a "coil" underneath the power transformer. This is an unused tap on the transformer secondary. The bared end was

SONY TC-105

only recorder on the Australian market that gives all these features for $221.60 list

Features ■ Four-track monophonic — 12 hours of recording and playback ■ Reliable all-transistor circuit using Silicon transistors ■ 3 speeds ■ Automatic recording volume control "SONY-O-MATIC" ■ Wide, smooth frequency response and rich output ■ Easy and quick tape loading with "retractamatic" pinch roller and self-threading "SONY-O-MATIC" reel ■ Speaker monitoring and public address facilities ■ Automatic shut-off, instant stop lever with locking facility, digital tape index counter, speaker on/off switch, tone control, voltage selector, professional level meter, etc.

Model TC-105 SONY's new model TC-105 is a versatile four-track monophonic portable tape recorder with truly dependable all-transistor circuit. Designed to meet everyone's purpose and requirements, it also contains professional facilities: 3 speeds, tone control, digital tape index counter, VU meter, lockable instant-stop lever, speaker on/off switch, voltage selector, 7-inch reel capacity, etc. Its extremely narrow gap head assures precise recording in wide frequency range and reproduction of high fidelity with rich 4 W. output from a large, oval dynamic speaker.

SPECIFICATIONS

Power requirement:	100, 110, 117, 125, 220 or 240 V., 50/60 c.p.s. 45 W.
Tape speeds:	Instantaneous selection 7½, 3¾ or 1⅞ i.p.s. (19, 9.5 or 4.75 cm/s.)
Tracks:	4 tracks, monophonic
Recording Time: (With 1800'/550 m. tape)	45 minutes per track, 3 hours in total at 7½ i.p.s. 1.5 hours per track, 6 hours in total at 3¾ i.p.s. 3 hours per track, 12 hours in total at 1⅞ i.p.s.
Reels:	7" (18 cm.) or smaller
Frequency response:	40-18,000 c.p.s. at 7½ i.p.s. 40-13,000 c.p.s. at 3¾ i.p.s. 50-6,000 c.p.s. at 1⅞ i.p.s.
Flutter and wow:	Less than 0.17% at 7½ i.p.s. Less than 0.3% at 3¾ i.p.s. Less than 0.4% at 1⅞ i.p.s.
Record/Playback head:	In-line quarter track
Erase head:	In-line quarter track
Inputs:	Low impedance microphone (1) High impedance auxiliary input (1)
Outputs:	8 ohm external speaker output (1) High impedance monitor jack (1)
Integrated record/ playback connector:	1
Speaker:	4 x 6" (10 x 15 cm.) PM dynamic
Power output:	Max. 4 W.
Transistors:	2SC402 (4), 2SB381 (1), 2SB383 (1), 2SD28 (2)
Diodes:	FRIU (1) IT22 (1) 5G-D (2)
Dimensions:	14¾ (w.) x 7¼ (h.) x 13⅜" (d.) (37.5 x 18.5 x 34.0 cm.)
Weight:	21 lbs. (9.5 kgs.)
Accessories:	SONY dynamic microphone 5" self-threading reel Pre-recorded 5" reel demonstration tape Earphone Connection cord Head cleaning ribbon Splicing tape
Optional accessories:	Telephone pick-up, TP-4S Microphone mixer, MX-600

SONY

Distributors: Jacoby, Mitchell & Co. Pty. Ltd., Sydney & Melbourne.

To: Jacoby Mitchell & Co. Pty. Ltd. 469-475 Kent St., Sydney.
Send me information on Sony Tape Recorders & name of nearest Sony retailer.

NAME.....

ADDRESS.....

.....

EA

"Replace Control Components, $32"

The above heading, taken from a repair quotation, carries a wealth of meaning, as my first story reveals. There is also a story about an unusual resistor defect, a set that blacked itself out for advertisements, and a fault that was cured with a wipe of a cloth.

Following my stories last month concerning unscrupulous servicemen, I received a most interesting letter from a reader. Since it tells the story just as well as I could, I simply quote the relevant portion.

"As a reader of your excellent magazine for many years, I have always enjoyed the Servicemen articles. The account in the current issue of an attempt by an unscrupulous serviceman to gyp his client prompts the following. I might mention that my knowledge and practical experience is reasonable, being a ham (VK2 - -), and having constructed equipment for more years than I care to remember.

"My TV set is a GE 11in portable, and had given good service since new until the on-off switch packed up last year. Being rather busy (or lazy) at the time, I suggested that my wife drop it in to the local serviceman for repair. I considered the job a trivial one, and knew it could be done for cents, but was quite prepared to pay a few dollars for the serviceman's time. You can imagine my astonishment on receiving the enclosed quotation in the mail a couple of days later.

"I phoned the serviceman, only to be told that testing some of the multipurpose valves in the set took some hours each, and a lot more of this kind of nonsense. However, when I said that I did not want the valves tested, but only the volume control and its associated switch replaced, I got nowhere. This may sound incredible, but it was like talking to the proverbial brick wall — all I got was a lot of paranoid ramblings. So, being completely fed up, I said I would be along shortly to pick the set up. This brought the response that the set was out of its cabinet, and I would have to pay for the 2 hours' work necessary to replace it. My reply was unprintable, but amounted to the fact that I would be there at 4 p.m. to collect the set, that it had better be ready, and that I would pay nothing.

"At the promised time I was there, collected the set, and in a very high dudgeon indeed (having been without it for three days), tore the cabinet off, found that a spring in the switch had merely slipped out of its slot, replaced it, and refitted the cabinet. Total time for the job: 25 minutes. As you know, the retail price for these little sets is well under $200, and to be asked nearly $50 for nothing was rather infuriating, to put it mildly."

The quotation to which the writer refers is set out in the accompanying panel.

There seems little doubt that this is a straight out case of blatantly dishonest practice. How anyone could seek to justify a charge of $32 for "replacing control components" (presumably the multiple potentiometer strip assembly) is beyond me. What is more, the wording of the quotation gives no guarantee that the $49 is necessarily the end of the story. It could easily be that our friend would "find" several more defects (probably valves) before the job was finished.

Nor is this a case of a parsimonious customer making an ill advised complaint about a charge of four or five dollars for 50c worth of components. This customer fully appreciated the serviceman's right to charge for his time and was fully prepared to pay for it. All he wanted was the control replaced at a price based on the cost of the new component plus normal service charges for the time involved. (He didn't envisage that it could be repaired as easily as proved to be the case.)

I have never performed such a repair in this model set but, to set the record straight, I contacted the manufacturer and obtained the relevant figures. This set uses a potentiometer unit; a combination of three pots — brightness, contrast, and volume with switch — all on the one base but having three separate shafts. This means that if one is faulty the complete unit must be replaced. The price for the complete unit to an accredited serviceman is $1.56, plus tax. The recommended retail price which a serviceman charges a customer is $2.60.

The manufacturer's charge to supply and fit such a unit is based on the retail price, plus one hour labour charge. This time is based on the possible need to perform other minor adjustments to the set, particularly those involving picture geometry. The total charge: $6.60.

In the event that the set is in obviously good condition in all other respects and needs nothing else done to it, it is possible to do the job in half an hour. In this case the total charge is $4.60.

All this means just one thing. If you have any doubts about the integrity of the servicemen available to you, take your appliance back to the manufacturer, or as near to him as you can get. This way you can be sure of a fair deal.

As far as our unscrupulous friend is concerned, neither the letterhead on which the quote was typed, nor the complaint about him was anything new.

I have encountered both several times over the years, as have my colleagues, but this is the most accurately described and documented case I have seen presented so far.

Nevertheless, this character's reputation is so well known that his nickname, within the trade, is, "Hungry."

Sleep well, "Hungry."

Reverting to more technical matters, here is a story about lost sync pulses that had me puzzled for a few minutes. It started out as a complaint which, translated, meant loss of horizontal hold. Some preliminary fiddling with the hold control restored the picture, but the setting was quite critical. Even if the owner hadn't volunteered the information, I had no doubt that it would be out of sync the next time he turned it on. At the same time, I became aware that the vertical hold was acting up and, while it could be made to look reasonably well, the two factors together suggested loss of sync pulse amplitude.

There are many possible causes of this condition, the most obvious ones occurring in the sync separator itself. Alternatively, weak valves or any other condition which causes a stage to "clip" the video envelope can seriously reduce the sync pulse height before it even reaches the sync separator. The video amplifier, the IF amplifiers, or even the tuner, can be responsible for such an effect.

In this case, however, the contrast and sound seemed normal, and I felt that it was more likely to be in sync separator or, perhaps, the video amplifier. Accordingly, I tried new valves in

Television Report

G.E. 11in Portable

Process	1.	Test picture tube	$ 3.00
	2.	Replace Control Components If the receiver does not pass air test or shows defects	$32.00
	3.	Test valves	add $ 7.00
			plus valve
			$49.00

Further report can then be submitted

Kindly advise us if we should continue with the repair

Yes, I know it doesn't add up, but that's what the man said.

each socket in turn, but neither made the slightest difference. So, out came the chassis.

A preliminary voltage check around the sync separator revealed nothing abnormal, so I followed this with a check of the video amplifier. Again, it seemed that all was as it should be, and I took a few moments off to study the circuit in greater detail. In fact, although I had handled this make of set many times before, this was the first time my attention had been drawn to this part of the circuit, and I soon realised that it had one or two unusual features.

The main one, as far as this fault was concerned, was the manner of providing the video for the sync separator. This was taken from the screen of the video amplifier (6DX8) which was fed from the HT line through a 10K resistor and bypassed with a 27pF capacitor. My first reaction to this rather unconventional arrangement was to question the efficiency of a video amplifier stage which was functioning as a true pentode only for the higher frequencies, since it was only here that the screen voltage was effectively pegged.

On reflection, however, I realised that was undoubtedly deliberate; just a convenient means of providing high frequency boost to compensate for all the high frequency losses which normally occur in any video amplifier. And after all, a partially bypassed screen is probably little different from a partially bypassed cathode which is often used for exactly the same purpose in other circuits.

Having thus analysed the circuit, I took another look at it in terms of the current problem. In particular I measur-

ed the video screen voltage again—and realised that I had been less observant than I should have been the first time round. The correct voltage for this element was clearly marked on the manufacturer's circuit as 160-180, yet I had been content simply to observe that the needle swung well up the scale on the 250V range, mentally register that there was plenty of voltage on the screen, and let it go at that.

When I measured it the second time, however, I checked the value precisely, and realised that it was up to 230V, only about 5V less than the HT line. Aha (I thought) no screen current. But why was there no screen current? All the other element voltages were near enough to normal, and a known good valve behaved in just the same manner as the one belonging to the chassis.

While I could have checked the screen current by unsoldering the appropriate leads, it was a good deal easier to measure the screen resistor, so I did this first, though I'm not quite sure what I expected to find. What I did find was a resistor marked 10K, and which undoubtedly had originally been this value, which was now measuring no more than 300 ohms. Why? How? Frankly, I don't know. Resistors which drop in value, rather than increase, are relatively rare, but they are not unknown. I even took the matter up with one of the resistor manufacturers on one occasion, but without any clear explanation being forthcoming.

With such a low value resistance in the screen circuit it is easy to understand why the set was so critical. Only a tiny amount of video would be developed across such a small "load," resulting in equally tiny sync pulses out of the sync separator. They were just enough to allow the set to lock in a critical way, but no more. Naturally, a new resistor restored everything to normal.

The moral of the story, if there is one, is not to get into sloppy habits in regard to voltage measurement. It's easy to do, I know, but it is not much harder to note the value exactly. By making this a habit, one automatically guards against little traps like the one I have just described.

My next story is, for the most part, one of a routine assignment. The main point of interest was not so much the fault, the symptoms, or even the component which failed, but rather the manner in which it failed.

The symptoms were lack of height, but complicated by the fact that this condition was not constant. Sometimes, when first switching on, the picture would be at near normal height, and would then increase to normal for a short while, followed by fairly rapid and marked drop in height. At other times the height would be well down when the set was switched on and would gradually increase to near normal. However, any particular trend would just as likely reverse without warning.

At its worst it was quite serious, the picture decreasing to no more than six inches high. At the same time, there was no decrease in picture width and these facts, plus the erratic nature of the phenomena, ruled out any suggestion of power line variations.

Naturally, I went straight to the vertical circuit, more particularly the vertical output stage. However, a quick voltage check around this section revealed nothing, even though I was able to observe some change in picture height while monitoring the most likely voltages.

Then I moved to the vertical oscillator, and here it was quite a different story. The plate voltage of this valve—half of a 6SN7—was wavering up and down in sympathy with the varying height. And even when the height appeared to be substantially steady, there were still minor voltage variations which indicated that the trouble, in some degree, was present all the time.

The valve operated from a 275V HT line, via a 150K decoupling resistor bypassed by a 5uF electrolytic. From this junction there was a 2.5M height control pot in series with a 330K to the valve plate. I backtracked along this line with the voltmeter, observing the same voltage variations at each junction until I came to the bypassed end of the 150K. They were still present here but, on moving over to the HT end of this resistor, they vanished. Well, at least I was close.

It was then that I noticed the 5uF electrolytic. It had, for want of a better expression, "gooed," or expelled some of its inside outside. And, believe it or not, it was this precise condition which was the cause of the bother. I proved this by simply wiping away the goo, whereupon the trouble vanished. As nearly as I could determine, the goo which had come outside from the inside had retained continuity and was providing a leakage path between the two terminals and/or from the inside to the outside. (I trust you can follow this inside out discussion.)

The interesting point about this fault, I feel, is that I was able to cure the trouble by simply removing the goo. In an emergency which prevented the capacitor being changed immediately, it would be worth remembering as a means of getting a set back on the air and keeping the customer happy. Naturally, such a capacitor should be replaced at the first opportunity.

My next story comes from a colleague. And, since he is not given to exaggeration, does not suffer from hallucinations, either natural or self-induced, and I have known him for many years, I believe him.

But without such a character reference it would be a different story!

It all started when we were talking shop one day and he dropped the casual remark, "Have I ever told you about the sets which wipe out advertisements?"

Then, seeing the look of incredulity on my face, he went on, "I'm not fooling, there is such a fault. It works in such a way that it cuts the picture when the advertisement comes on."

"By crikey, that's not a fault, mate. That's the discovery of all time. If you can reproduce it, your fortune's made."

"Well I probably can" — he was quite serious now — "and, strangely enough, the customer does complain that the picture disappears when the advertisements come on." (Who said the public don't like advertisements?)

He went on to explain the condition which produces this strange sense of discrimination on the part of the TV set. Basically, it involves the EHT system and, at least in the cases he had seen, a very sick EHT rectifier. A sick EHT rectifier normally produces an effect called blooming; an increase in picture size with advancement of the brightness control, sometimes accompanied by no increase in brightness or, more commonly, a decrease. Similarly, an increase in contrast, either by means of the control or by reason of the program content, can increase picture size and effectively darken the area of picture remaining.

I naturally wanted to know what this had to do with a set's supposed ability to distinguish between advertisements and programs. (I'm sometimes hard put to it to distinguish them myself!) At first my colleague was inclined to adopt the attitude that he didn't know why it happened; he only knew that it did happen — and why couldn't I just take his word for it and stop worrying about the technical details?

But I had no intention of being sidetracked — not with a story like this at stake. So we finally made a serious attempt to find an acceptable explanation. In reply to a number of questions which I put to him, we established the following facts. He had seen it happen, and seen it happen in more than one set. The effect was to cause the picture to blackout due to extreme blooming. The effect was not necessarily consistent.

The next question I raised was the nature of the difference between advertisements and program material which the set was able to sense. And there must be some such difference if such a thing is to happen with any degree of consistency. Three differences were suggested; a higher contrast in advertisements than in a lot of program material, a higher sound level (though the TV stations deny this), and the fact that the video drops to black before and after an advertisement.

This last point was quickly disposed of. For one thing, I doubted whether the video level does necessarily drop to black, in the strictly technical sense, and for this reason there would be any number of similar fades during a program, as well as before and after an advertisement. In any case, I still couldn't see how this could be a mechanism by which the discrimination was controlled. My colleague agreed, and we wrote that one off.

Much the same reasoning applied to the sound. Sound in a program can be high on occasions, yet there seemed to be no suggestion that this could cause a similar effect. And again, there seemed to be no likely mechanism by which this could have any effect on the picture.

This left the difference in contrast, and I had to admit that this seemed the most likely explanation. As I mentioned earlier, increased contrast, under conditions of inadequate and poorly regulated EHT can cause extreme blooming and an overall darkening of the picture. Large areas of peak white, in endeavouring to draw more final anode current, would only succeed in lowering the EHT voltage. And if there is enough peak white the end result may well be a picture so dark that is is unrecognisable.

But this is by no means a completely satisfactory explanation. Advertisements have no monopoly of high contrast pictures, which often occur in good quality program material. Why, then, did the customer confine his complaint to the effect on advertisements? I suggest that psychology played a part in this,

possibly coupled with the customer's viewing habits. If he tended to prefer the older movies, which are usually pretty wishy-washy, then the difference between these and most advertisements would be sufficient to seriously upset the brightness level when the latter occurred.

By the time this situation had occurred several times in succession, probably within one program presentation, the idea would have implanted itself in the customer's mind to the point where he would continue to note all instances which supported the theory, but probably tended to overlook those which did not.

In short, I don't think such an effect would be really consistent. At the most, it would occur when conditions were favourable and these conditions could last through an entire program. So nobody's going to make a fortune out of that one!

And here is a short routine story, but one worth telling for the benefit of readers who have not struck it before. The main symptom was what is sometimes rather loosely referred to as "cog wheel effect," being a variation of the classical cogwheel pattern as shown in textbooks.

Initially, the picture was lacking horizontal sync. This responded to the hold control, but was extremely touchy and even when it did lock, it exhibited the so-called cogwheel pattern. More precisely it presented all vertical lines as a low amplitude sign wave pattern, amounting to several cycles from top to bottom. (By comparison, the cogwheel effect illustrated in most textbooks might be likened to a square wave rather than a sine wave.)

One cause of the symptom I was looking at now, in some makes of sets, can be traced to the sync separator, confirmed by the further symptom of poor vertical hold. However, such was not the case in this instance, the vertical hold being quite normal.

The most likely alternative was the vertical oscillator system itself. This used a 6CG7 twin triode in the well-known Synchro-Guide circuit and I felt certain that the trouble would be somewhere in this section. As a matter of course I tried a new valve, but I wasn't really surprised when this didn't help.

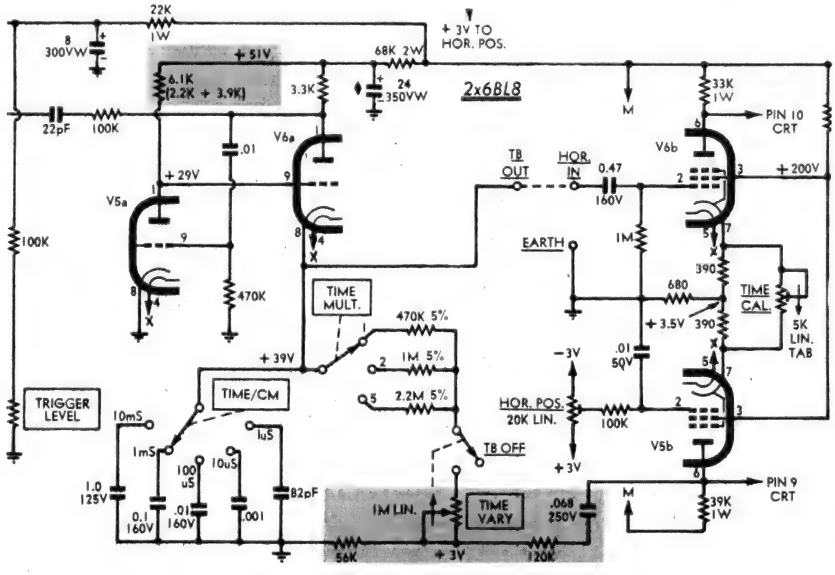
Within the Synchro-Guide circuit itself, the most likely section is an "anti-hunting" network connected to the cathode of the first triode. This consists of 3.9K resistor and a .47uF capacitor in series between the cathode and chassis, and failure of either component, in varying degrees, can create a variety of horizontal sync faults. I checked the 3.9K first. It was spot on value, leaving only the capacitor. I fished it out and gave it a rough check with the ohm meter, experience telling me just how far such a capacitor should kick up the scale as it takes a charge. In fact, I could detect little or no kick, suggesting much reduced capacitance. Sure enough, a new capacitor cured the trouble completely.

It is most likely that the faulty capacitor still retained some capacitance, since previous cases where it has failed completely have produced quite different symptoms, normally critical horizontal sync and random displacement of horizontal lines, much as if there was no flywheel circuit at all. ■

A READER BUILT IT!

Circuits and devices which we have not actually tested in our laboratory but published for the general interest of beginners and experimenters.

Improving Horizontal Linearity of "1966 3-inch CRO"



The new and changed components are in the shaded areas.

"In recent correspondence and telephone conversations, the performance of the "1966 3-inch CRO" was discussed, with particular reference to the linearity of the horizontal amplifier. I suggested a bootstrapping arrangement which could be used to improve the linearity of this stage. In a letter to me on the subject, you said:

" 'The major source of non-linearity is the horizontal amplifier, which, for economy reasons, is operated under "all out" conditions. The timebase of the prototype unit is nevertheless quite good in terms of linearity, suggesting to us that perhaps your own unit has either a faulty component or a set of components whose out-of-tolerance spreads are sufficiently different from the prototype to upset linearity.

" 'We suggest that you try altering the value of the resistor in the plate circuit of V5a (shown originally as 6.8K) as this resistor plays a major part in determining timebase linearity.'

"Acting on your advice, I inserted a variable resistor in place of the 6.8K. Adjustment of the variable resistor did achieve a slight improvement by narrowing the effective portion of the discharge curve of the time base capacitor. The optimum value was determined as 6.1K, so the 6.8K was replaced by 2.2K and 3.9K in series.

"Optimum values were then ascertained for the bootstrapping circuit which I had previously tried. The additional components, with values and relevant voltages, are shown in the modified circuit. The object of this modification was, of course, to try to achieve a constant voltage drop across the timebase resistors and thus an apparent constant discharge rate of the time base capacitor in an endeavour to improve the linearity of the horizontal sweep. The modifica-

(Continued on page 174)

Checking Pickup Tracking Error

"During some experiments involving pickup arm offset I evolved a trial and error method of determining optimum offset angle. This method can also be used to locate the base position for a pickup if the manufacturer's template is missing.

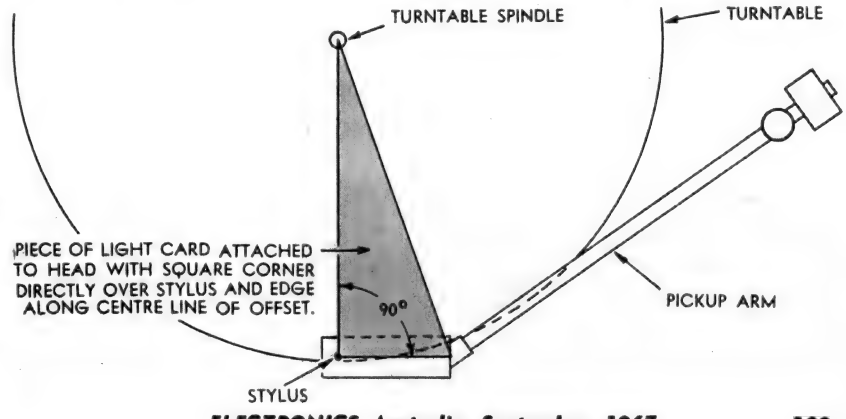
"All that is required is a triangle of light cardboard having one corner a rightangle and with one of the adjacent sides short and one long. The short side is carefully attached to the pickup head with the 90 degree corner exactly above the stylus point and the edge of the card perfectly aligned along the centre line of the cartridge. The long side must be long enough to reach the centre of the turntable with the pickup at the edge of a 12in record.

"Then, by swinging the pickup from outside to inside of the record the tracking error can be checked by the position of the straight edge of the card in relation to the centre of the turntable spindle. For a perfect arm (there is no such thing) the edge of the card would not leave the centre of the shaft. In practice it will move from the centre by a small amount, which can be reduced to a minimum by juggling the base of the pickup.

"In the case of the arm I was working on when I devised this system, I was able to keep the edge of the card within the diameter of the spindle, which was better than any commercial arm I had tried at that time. I still have the original arm and have made some measurements from it. The angle of the head to the arm is 35 degrees, the overhang 13/16in, and it is 8-11/16in from stylus point to pivot.

"The tracking error varies from − 2.5 degrees at the outside of a 12in record, through + 1 degree halfway across, to −2.5 degrees again at a distance of 2¼in from the centre."

(From Mr A. G. Murrell, P.O. Box 18, Penola, S.A.)



THE NEW ADC-40/PRITCHARD TONE ARM. MK. II

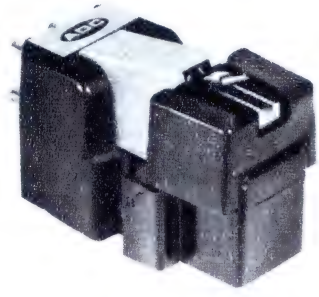
ADC. 40 Mk 11 PRITCHARD ARM

Is there REALLY anything special about this instrument? Yes, sir, there certainly is! Whilst it is true that other brands also offer dynamically balanced, precision pickup arms with low bearing friction, their overall mass is higher and, in most cases, SUBSTANTIALLY HIGHER. As is well known today, inertial mass has a profound effect on the sound of modern, high-compliance cartridges.

Another outstanding feature of the Mark II is that the rider weight (outrigger weight), plus its horizontal bar, are REMOVED after accurate adjustment of stylus pressure. In other arms, which use a similar or identical arrangement for the application of playing weight, the outrigger weight, plus its bar, are a fixture, which further substantially increases the operational inertia. The "FLYAWAY CALIBRATOR" of the ADC.40/Mk. II weighs 29 grams . . . 29 grams less to be dragged about by the delicate stylus mechanism of a modern stereo cartridge!

Spurious resonances in the audio range are another of the troubles that plague conventional metal arms, as metal parts tend to "ring" and some of this ringing gets transferred to the stylus, resulting in unwanted signals that cannot be measured but heard by sensitive listeners. These resonances can be reduced by damping them with rubber or wood. A highly satisfactory solution to this problem is to construct the arm itself from wood. Provided, as in the case of this arm, the wood is specially treated to prevent warpage, well-nigh perfect results are obtained and nothing has to be compromised.

THE NEW ADC-10E/MARK II AND ADC-220 STEREO CARTRIDGES



The ADC-10E/11

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AUDIO TOPICS

RECREATING HISTORY WITH RECORDED SOUND

A 14-channel tape system is used in a reconstruction of one of the U.S.A.'s most historic buildings to recreate in sound the events which led up to the Declaration of Independence.

The equipment is housed in an exact replica of the original Independence Hall in Philadelphia, built at Knott's Berry Farm, a family amusement centre located some 40 miles south-east of Philadelphia. Visitors are able to observe a recreation of the rooms used by the Continental Congress during the events which led up to the signing of the Declaration, and hear a dramatic presentation of the speeches and sound effects associated with the event.

The setting for the sound presentation is a reconstruction of the Assembly hall where the historic document was signed. Spectators are escorted in groups into the hall and sit along one side of the 40ft x 40ft room, roped off from the exhibition area. They are accompanied by a tour guide, a pretty girl dressed in colonial dress of the period. In the exhibition area, tables, chairs, candles (electrically illuminated), ink stands and other memoribilia of the period serve as visual focal points for the program and set the mood for the audio presentation. However, the show relies more on the sound dramatisation to recreate the historical auro of the occasion — the spirited discussions and excited conversations that attended the original event.

With all the visitors settled, and after they have taken in the setting, the tour guide turns a key in a door casing, and the presentation begins. The house lights dim, and the electric candles on the delegates' tables begin to burn. The audience is transported in imagination to the 1770s as the 56 delegates to the Second Continental Congress are heard arriving, entering the room, walking through the assembly and seating themselves at their tables. Chairs scrape, men talk and laugh, papers rustle. Then, dramatically, there is the sharp rap of a gavel and the sounds die away. John Hancock, President of the Continental Congress, recognises Richard Henry Lee as the first speaker.

During the presentation, a battle rages outside the building, a marching band tramps past playing "The White Cockade," the town crier proclaims the surrender of Yorktown and the Liberty Bell toll. As John Adams delivers an impassioned speech, the audience hears him stand and walk in ghostly fashion from one side of the room to the other.

This historic wizardry is accomplished with an elaborate audio system, called Stereo-Rama Fourteen by its creator Philip Stuart, Hollywood producer of documentary films and exhibits. Stuart has worked closely with Walter Knott, founder of Knott's Berry Farm and builder of the new Independence Hall, for about eight years.

According to Stuart, once Walter Knott made the decision to build Independence Hall, more than two years research was devoted by producer Stuart and his staff to combing contemporary accounts of the assemblies, diaries and letters of the delegates to reconstruct their speeches at the sessions.

Stuart has placed 56 coincidentally, the number of delegates, James B. Lansing speakers throughout the exhibit room to give depth and presence to his special effects. They are located under the delegates' tables, in the walls and in the window casings and fireplaces.

The heart of Stereo-Rama Fourteen is a pair of Ampex AG-300 series solid state professional audio recorders modified to handle one-inch wide, 1.5 mil magnetic tape and provide 14 channels (the modified recorders are called AG-300-14). The machines run at either 7½ or 15 inches per second. Ten of the channels carry dialogue, three are used for special sound effects and the final track controls the room lights, candles and audio special effects switching from speaker to speaker.

The program was recorded in the room where it is presented. Stuart gathered more than twenty famous voices from the golden age of radio, motion pictures and the Broadway stage, including Jay Jostyn, Brainard Duffield, David Bond, Marvin Miller and Nestor Paiva, to portray the voices of history. Jostyn, radio's "Mr District Attorney," for instance, plays John Hancock. These well-known voices add a

Two of the tour guides at Knott's Berry Farm in colonial dress, standing in front of the replica of Independence Hall. Construction of the building took two years. Some 140,000 clay bricks were hand finished, special paints mixed to duplicate originals and intricate hand carvings made to ensure authenticity of the replica.

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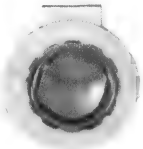

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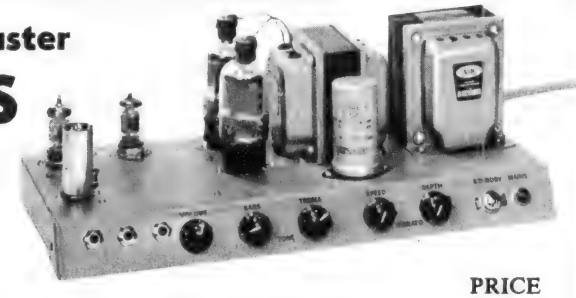

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dimension of familiarity to the all-encompassing stereo program.

All of the actors gathered in the Assembly Hall for 10 live recording sessions over a period of six weeks. Accoustical flats on their tables reduced the effects of cross feed. Footsteps, rustles and chair-scrapings were recorded as they took place. The final effort is a blend of these sessions, with the special effects, outside noises and control track added later.

The Ampex equipment is rack-mounted in the spacious projection room of the building's second-floor movie theatre. In the original building, the space was rarely used until toward the beginning of the nineteenth century when a museum was installed, complete with stuffed birds. To provide duplicating and standby capacity, one unit is a record/reproduce machine and the other is a reproduce only. The recorders are used on alternate days, leaving the extra unit for standby. The combination allows operators to make their own play copies of tapes from masters and enables them to change and upgrade the program at any time.

Each14-track tape machine uses seven two-track Ampex professional audio recorder electronics units, modified to include a muting relay to short line outputs in every mode but "play." These units have been transferred to deeper chassis for more effective cooling (units run for 11 hours a day). New connectors were installed to mate electronics with the AG-300-14 head assembly. The Ampex equipment is set up for virtually automatic operations of the entertainment cycle so a tour leader need do no more than insert a key in a tamper-proof lock in a door casement to start the show.

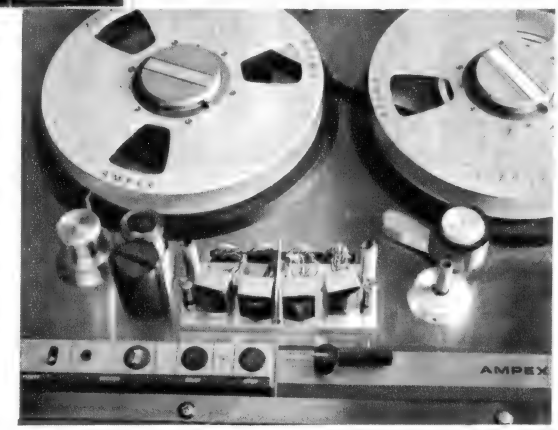
To accomplish this, Ampex engineers installed photo-cell assemblies and memory systems in the control boxes of the AG-300-14 recorders. Lights and photo-cells are mounted in the tape path. As the tape runs between the cells, they sense transparent leaders spliced at the beginning and end of the program. At the end of the program, the machine goes into rewind (approximately one minute to rewind the entire program). When the beginning of the program is sensed, a forward relay cues the show up automatically.

Building 14-track recorders posed special problems. The recorders were modified to take the wider tape by installing take-up and wind motors with double the normal torque. Locking-type holddowns were permanently attached to the assemblies. Wider capstan and reel idlers were added and longer shafts were made for the capstan assemblies. Heavier solenoids were used for the capstan idlers and heavy duty silicon rectifiers were installed in the transport power supply.

Staggered, optically-aligned, fixed azimuth audio heads with low impedance, 200-microinch gaps were designed to give adequate signal-to-noise ratios from the narrow tracks and retain good tracking and frequency response. This design also gives minimum crosstalk between channels and good separation.

ABOVE: Philip Stuart, creator of Stereo-Rama Fourteen, makes minor adjustments to one of the Ampex tape recorders used at Knott's Berry Farm.

RIGHT: Close up view of the deck of one of the specially modified Ampex recorders, showing the 14-track head stacks, lengthened capstan and reel idlers and locking reel hold-downs.



Two patch panels, one for each of the recorders, were installed and interconnected so that the output which normally comes from the reproducer can be jumpered to lead from the recorder; and the recorder input, which normally is connected to an external source, may be jumpered to lead to the reproducer.

The automatic control circuit for the visual effects and audio special effects employs frequency sensitive circuits with solid-state SCR (silicon controlled rectifier) switching to control the house lights and candles and to switch the three audio special effects channels to any or all of ten surround speakers.

Eight Lansing S-4000 solid-state power amplifiers were built into one rack to handle the 14 channels at 40 watts per channel. Allen Bradley lock pots are located in the same rack. The fourth rack in the system carries a 14-channel monitor system.

In the Assembly Hall, 38 Lansing speakers are built into the window casings. Six unique Lansing speakers are mounted in the wall panelling, using balsa wood panels as voice and cone resonators.

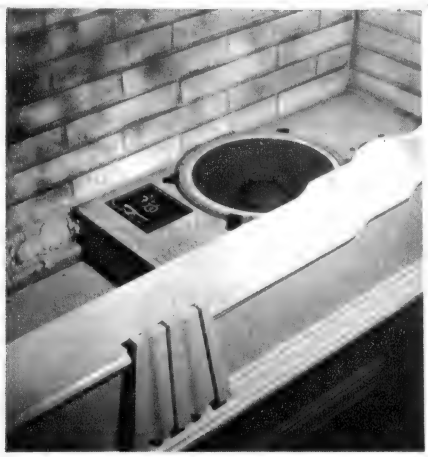
Two standard Lansing S-7 speaker systems (standard studio monitors) are mounted in the fireplace casements and 10 modified S-8 systems are located under tables, concealed by tablecloths. These systems use Lansing 375 theatre drivers for mid and upper ranges and S-7 woofers to give the desired bass quality.

Plans to add additional special effects to the program, such as flickering candles and electric fires in the fireplaces, were abandoned, as it was considered that they would distract from the audio portion of the program.

"This audio drama is a slice of reality," Stuart said. "We have been careful to maintain a production standard befitting the Independence Hall project, the most elaborate reconstruction of any historic building in the world, and the subject the birthplace of the world's greatest experiment in human freedom."

According to Stuart, more than 450,000 people have seen the program since the exhibit was opened to the public on July 5, 1966. "Almost a third of the visitors have taken the trouble to write notes to Mr Knott expressing their enjoyment of the program," Stuart said.

Knott and Stuart are now working on a presentation covering the American Revolution. It will be a similar program, depending more on audio effects than visual ones, and will be housed in its own special building.



Concealed speakers are located in the framing of each of two fireplaces in the Assembly Hall (left) and under ten tables in the same room (right).

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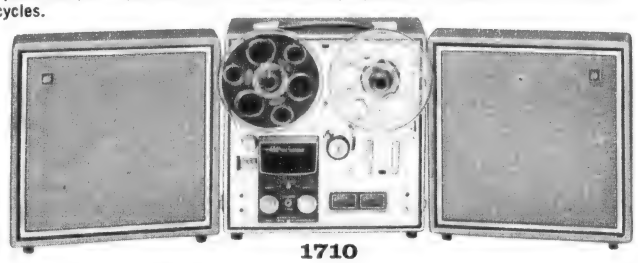

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Classical reviews

By JULIAN RUSSELL

Bruckner — Symphonies No. 3 & 4

BRUCKNER — Symphony No. 3 in D Minor (1889 version). Vienna Philharmonic Orchestra conducted by Carl Schuricht. HMV stereo ASD2284.

I have often written of my liking for Schuricht's manner of presenting Bruckner without too much emphasis on the composer's ponderous mysticism. He keeps slow tempos moving, where most other conductors make them sound very solemn indeed. This is particularly noticeable in the second movement of the Third Symphony, where the music remains always graceful and never morbidly introspective. And you will find the same graceful treatment in the Scherzo. The big muscular theme of the first movement emerges majestically and with enormous authority, a longer-than-usual reverberation period giving it plenty of time to hang in the air but without any clouding of succeeding bars.

In a fine performance, Schuricht's finest moments come in the Finale. This is built on two contrasting themes, one a chorale-like passage in block-like chords, the second a dance tune. Though they are often combined, Schuricht keeps them both impressively separate so that their simultaneous statement can be discerned without recourse to a score. Only in this movement does the Vienna Philharmonic's stately brass become a trifle strident, though I must admit that it is not without effectiveness, as used here. To those seeking a recording of the symphony, I can recommend this as the best at present available, at any rate on the Australian market.

Schuricht, by the way, uses the 1889 version of the score, "edited" and, according to some, debased by Franz Schalk. A similar situation exists among the various versions of other Bruckner symphonies for the composer himself made many revisions of his originals, sometimes off his own bat, but all too often on the recommendation of others — even pupils. All but the most dedicated Brucknerians will find such conflicts about credentials tiresome and unprofitable. Moreover there is always so much controversy about the composer's final wishes that much of the argument remains a guessing game.

★ ★ ★

BRUCKNER — Symphony No. 4 (Romantic). Vienna State Symphony Orchestra conducted by Heinz Wallberg. Concert Hall Stereo SMS-2489.

Newcomers to Bruckner's music will find this a much easier work to digest and appreciate than the D Minor (No. 3). Its title, "The Romantic" describes it admirably. The distant horn notes of the opening theme are perhaps the most romantic written since those at the beginning of Weber's "Oberon" Overture. And they are played here in a manner that would not be put to shame by the great Barry Tuckwell's own performance with the London Symphony Orchestra. Tuckwell told me, when he was in Australia last year, that he always finds this one of the most worrying passages he is ever called upon to play. "If it doesn't come off you might just as well give the performance away and play another symphony," he told me.

A point to be remembered is that this Concert Hall issue is offered at little more than half the price of the superb LSO performance with Kertesz for Decca. And at that price it is very good value indeed. Now and again some added richness of string tone would have been profitable. I got the impression that the number of first violins was not quite up to strength. The engineering is good, though it tends to thicken a little through the middle in the loudest climaxes. This, however, depends so much on the conductor and not the sound engineer that the same experience can often be had in a concert hall. All in all, I consider this an excellent buy both for tyros and devotees.

★ ★ ★

DVORAK — Symphony No. 5 in E Minor, Op. 95 (From the "New World") Cleveland Orchestra conducted by George Szell. Epic Stereo BC1026.

The more I hear George Szell and the Cleveland the more unbounded my admiration becomes. I think I am safe in naming the orchestra the finest precision instrument in the world today. Other great orchestras have other characteristics, the Vienna Philharmonic unmatched urbanity, the Berlin Philharmonic superb poise and solidity, the London Symphony fire and elan, the Philadelphia sumptuous richness of tone. But what makes the Cleveland perhaps my favourite among them all is the classical purity of Szell's interpretations.

Readers might find the following reminiscence significant. When I was in Vienna for five weeks in 1965, I attended many orchestral concerts which were all well attended. The Cleveland and the LSO were among the visiting orchestras for the festival. But the only concert at which I saw every other conductor then in Vienna — Josef Krips, Keilberth, Bohm, Ludwig and others — was Szell's. They must have all felt that it was an occasion that they couldn't possibly afford to miss.

Szell recorded the "New World" on 78s for Parlophone back in the 1930s. I thought then it was the best performance I had ever heard and kept it for many years until it went the way of all 78s. (It would be interesting to know just how many classical 78s survive today.) Listening to this new recording I see no reason to change my mind, and I am not unmindful of Toscanini's great performance for HMV. Szell is half Czech, half Hungarian, and has a complete understanding of Dvorak's flashing changes of mood, in the first movement. Moreover, CBS recording engineer has been alert to every tiny change of orchestral timbre that accompanies them.

And Szell's Apollonian purity of style insists on a cor anglais solo in the famous Largo delivered without the slightest trace of a sentimental vibrato. The opening brass phrase is noble without pomposity and the whole is a model of dignity and spacious emotion. The many changes of tempo and rhythm in the Scherzo are all brought off with inimitable exactness, without ever losing their beguiling lilt. And the Finale swaggers along to a heart-lifting climax. I don't think it will take you long to learn to live with the rather slow tempo at which Szell takes the second subject of the Finale. It might sound a little strange at first. Indeed, it still does to me. But I can see Szell's point when the movement is reconsidered in retrospect. I can think of showier versions of this symphony, but none so perfect in taste, execution and engineering.

★ ★ ★

STRAUSS (RICHARD)—Dance of the Seven Veils from "Salome"; Till Eulenspiegel's Merry Pranks; Don Juan. New York Philharmonic Orchestra conducted by Leonard Bernstein, CBS SBR235209.

Unlike Szell, Leonard Bernstein seldom allows considerations of clasical purity of proportions to influence his essentially Dionysian readings. And he lets himself go almost entirely without restraint in the Dance of the Seven Veils. He slows up slow melodies — the famous waltz theme on the low strings, is one example — until they drag tiresomely and so destroy the voluptuousness the composer intended. The result is often close to caricature. Then along comes the coda and Bernstein dashes off as if at the start of a Grand Prix race.

You will hear the same indulgence in the grosser emotional urges of Strauss' music in "Till Eulenspiegel" but here the superb playing of the New York Philharmonic allows him to coast along on the orchestra's virtuosity. They don't sound nearly so hard driven or so reckless. But despite this virtuosity I have heard many other readings I like better and which make the work's witty points more deftly.

On the other hand the performance of "Don Juan" is the best I know. The whirling energy of the opening theme is quite overwhelming and the whole performance bubbles with the youthful energy of its creator. True, whenever the chance presents itself to sentimentalise a melody — he finds one not unexpectedly in the oboe solo — Bernstein seizes it. But this music is better able to withstand such assaults without damage than the two mentioned above. The engineering of all three works is superb.

★ ★ ★

POULENE—The Story of Babar, the Little Elephant.
HARSANYI—The Story of the Little Tailor.
Related by Peter Ustinov with the Paris Conservatoire Orchestra conducted by Georges Pretre. HMV Stereo OASD2286.

One side of this charming disc should delight the young of all ages. I believe the story is so well known that it calls for no description from me, though this is the first time I have heard it myself. It is recited by Peter Ustinov and is ac-

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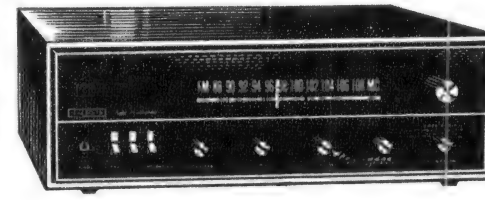

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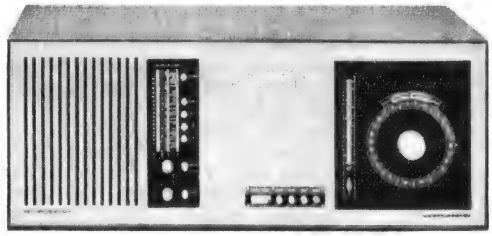

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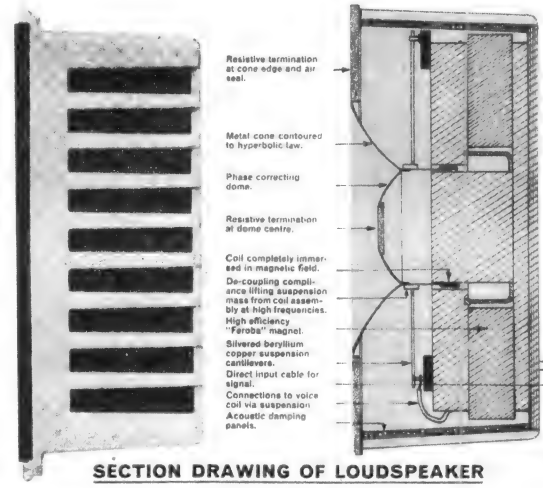

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companied musically rather in the manner of Prokofieff's "Peter and the Wolf" though without the latter's thematic labelling of the characters. Instead Poulenc provides delicious little melodies —the waltz when Babar buys himself some clothes is one of the sweetest trifles I have heard for a very long time —eloquently descriptive of the narrative.

"The Little Tailor" is also quite charming but its sophistication is not so well hidden as in the Poulenc. It, too, has its eloquent moments, of which perhaps the most immediately attractive is the description of a wild boar grazing peacefully. But, generally speaking, Harsanyi's tunes are more commonplace than Poulenc's and it tends from time to time to archness in a manner alien to "Babar." But this is a factor that will be of importance only to grown-ups and even some of these might well find the whole disc equally delightful. Children will love both sides without any reservations.

★ ★ ★

ARNE—Songs to Shakespeare's Plays. Maureen Forrester (alto); Alexander Young (tenor). Vienna Academy Chamber Choir; Vienna Radio Orchestra conducted by Brian Priestman. Calendar Classics Stereo SC66-9,138.

British soloists with a Viennese choir and orchestra give a satisfying account of these all-too-seldom heard settings of Arne. In all, there are 15 songs but, strictly speaking, only 13 come from the plays. Two, "Soft Flowing Avon" and "Sweetest Bard," are settings of odes to Shakespeare though they fit quite easily into the context of the others, both stylistically and atmospherically. Arne worked in a period dominated by the music of Handel and J. C. Bach but managed to keep his style uninfluenced by the current fashion. It is quite individual and usually highly expressive of the texts.

Maureen Forrester (contralto) sings some of the songs, Alexander Young (tenor) the others. Both are good and any shortcomings they might show are common to the majority of English oratorio singers. Thus Miss Forrester's voice is a trifle heavy for some of the lighter numbers but is heard to splendid advantage in "Soft Flowing Avon." Alexander Young has perfect diction — every syllable is audible — but tends to preciousness in his delivery. These, however, are details that might easily be disregarded in enjoyment of the songs themselves. The string tone is occasionally a thought too rich for the harpsichord and on the first side the balance varies from item to item, but becomes more secure on the reverse. At its budget price ($2.95) I consider it an excellent buy.

★ ★ ★

BEETHOVEN — Septet in E Flat Major, Op. 20. Members of the Vienna Octet. World Record Club Stereo S/T4160.

Here is a delightful example of chamber music at its most mellifluous. The work is an early one, full of the most graceful melodies and felicitous invention. Those who already know the Vienna Octet need no further recommendation from me than an assurance that they will find them at their best here. Everything is effortless, spontaneous, flexible and immaculate in ensemble. Nothing is hurried, nothing is dragged. Just the right tempo has been chosen for every movement. And, although the original recording was made back in 1960, it stands up well to more recent competitors in tonal quality and balance. It is music that can be listened to and enjoyed without the slightest effort.

★ ★ ★

DEBUSSY—Pour Le Piano. Images, Books 1 and 2. Children's Corner Suite. Philippe Entremont, Piano. CBS Stereo SBR235205.

I prefer Entremont in more extroverted music than the Debussy he plays here. His far from gentle treatment of the first piece in "Pour Le Piano," with its crisp touch more suitable to the music of Ravel, I found too brusque and showy for my taste. He is better in the second, a Sarabande, and in the Toccata the fast passages are beautifully aerated with, however, here and there, a momentary carelessness.

His playing of the two books of "Images" is mixed, some of it is suitably delicate with careful attention paid to the composer's shifting sonorities, some of it too flashy altogether. I played the old Gieseking recording of "Images" immediately after Entremont's and enjoyed the pieces vastly more. I liked best Entremont in the six pieces of the Children's Corner Suite, even though in these he would be far from my first choice. Moreover, the sometimes rather squashy tone of his piano made me feel far from comfortable at times.

★ ★ ★

STRAVINSKY — Les Noces. Basia Retchitzka (soprano); Lucienne Devallier (contralto); Hugues Cuenod (tenor); Heinz Rehfuss (bass). Swiss Romande Orchestra conducted by Ernest Ansermet.
Symphony of Psalms. Le Choeur des Jeunes de Lausanne; Le Choeur de Radio Lausanne. Swiss Romande Orchestra conducted by Ernest Ansermet. Record Society Stereo S/6226.

This is a splendid coupling of two of Stravinsky's finest works, though I must warn that neither is easy to listen to by those unfamiliar with what might be dangerously referred to as Stravinsky's middle period. "Les Noces" came immediately after "Le Sacre du Printemps," during the period when the composer's chief preoccupation was rhythm. But where, in the "Sacre" he used a very large orchestra in a devastating assault on the pulse and ear, in "Les Noces" he uses only four pianos, a very large percussion group, and a quartet of solo voices. Its rhythmic impact, however, is just as overwhelming as that in the "Sacre."

It was originally intended as a ballet, the subject of which was a Russian peasant wedding in the middle nineteenth century. It never won the acclaim of its three great predecessors, "Firebird," "Petrouchka," and the "Sacre," but has recently been revived in Europe and the U.S. with more success. It is starkly descriptive and I still find it enormously exciting, especially in Ansermet's clean cut and vigorous performance, about which the only criticism I can make is an occasional hesitancy in a change of tempo. The sound (1961) is still good and the balance between voices and instruments all that it should be.

Stravinsky has all his life been a deeply religious man and his Symphony of Psalms is a work of moving reverence and faith. The composition of the orchestra is unusual — no clarinets, violins or violas but extra wind and two pianos. The effect is both astonishing — at first — and impressive. To enjoy full appreciation of its subtleties I suggest you turn up the volume control just a little. You will find it quite unlike anything you have ever heard before. And again Ansermet's reading is admirable and his performers, with minor reservation only, fine.

★ ★ ★

PROKOFIEFF—Piano Concerto No. 3 in C Major, Op. 26. Piano Concerto No. 5 in G Major, Op. 55. Samson Francois with the Philharmonia Orchestra conducted by Witold Rowicki. World Record Club Stereo S/T4159.

Samson Francois has a very big public in France which I find strange because, generally speaking, the French are not a sentimental people and pride themselves on their wit and sense of proportion. I am aware that this is a dangerous generalisation and that some French are as sentimental as the Irish. But Francois is a pianist I would never have expected to win popularity from so large a section of the public. In his choice of, and frequent changes of tempo he often shows scant respect for the composer's wishes. In short, his is the opposite of classically proportioned playing.

The Third Concerto fares worst under this ill-treatment. It loses its sparkle and its characteristic pugnacity. The Fifth is an odd work, comparatively unknown to the majority of those concertgoers familiar with the third. But it is better suited to Francois' rhapsodic style, with its overdone rubatos and freakish speeds. Another point that put me off this disc is the undue prominence awarded the soloist at the expense of interesting orchestral parts, the more to

be regretted since, when his orchestra can be heard, Rowicki is always interesting. And still a third shortcoming is the obvious absence of rapport between conductor and soloist on many important matters of collaboration.

★ ★ ★

MENDELSSOHN—Symphony No. 3 in A Minor Op. 56 (Scotch). Gewandhaus Orchestra of Leipzig conducted by Franz Konwitschny. World Record Club Stereo S/T4207.

Like whisky this is known as Scotch, not Scots or Scottish, a point on which members of that race are touchy in other contexts. But that apart I found this performance very commonplace, the orchestra (once one of Europe's finest though many years ago), dull and the engineering woolly. Even at its club price it's no bargain when it is known that Peter Maag's admirable recording of the "Scotch" with the London Symphony for Decca has just been issued here on that company's cheap "Ace of Clubs" label and has, as a bonus not included in the WRCs disc, an equally good account of the "Hebrides" overture.

★ ★ ★

ELGAR — Pomp and Circumstance Marches Op. 39, Nos 1-5. Elegy, Op. 58. Sospiri, Op. 70. Overture "Froissart," Op. 19. Philharmonia and New Philharmonic Orchestras conducted by Sir John Barbirolli. HMV Stereo OASD2292.

You'll find grand, stirring music in the Marches on this disc, all wonderfully scored and played in a manner that reflects the scarlet and gold of Edwardian pagentry. All are wonderfully scored, and who can write so well for brass, Sibelius excepted? Nobody that I know. Nowadays when contemporary composers mute their brass so that all you hear are little squawks, students should study these scores again and again to appreciate how noble that section of the orchestra can be made to sound — if you know how.

Just as the Marches proclaim Elgar's mastery of brass scoring, the items on the reverse advertise his skill with the string section of the orchestra, too. The only item I failed to enjoy was the early overture, "Froissart" which, despite its abundance of youthful rhetoric and chivalry, I can imagine interesting to none but musicologists today.

By the way Barbirolli is, despite his name, of British birth and upbringing and in his understanding and love of Elgar's music is not surpassed by any other British conductor, Boult and Sargent included.

★ ★ ★

LISZT — Piano Concerto No. 1 in E Flat Major. Piano Concerto No. 2 in A Major. Edith Farnadi (piano) and the Vienna State Opera Orchestra conducted by Sir Adrian Boult. Calendar Classics Stereo SC66/9140.

Edith Farnadi plays these two concertos pleasantly enough with perhaps a little too much dwelling on some of the more lyrical moments. She is nothing if not romantic. Personally I like to hear a little more brio in these exhibitionist pieces, and that is a missing factor on this recording. At any rate, even if it were there in the actual performance, dated woolly sound would prevent it being appreciated. Although it is put out at an economy price, $2.95, there are nowadays many preferable competitors that should be considered first. ■

DOCUMENTARY RECORDS

Reviewed by Glen Menzies

JOHN F. KENNEDY. THE DEATH — THE WARREN REPORT — —THE CONTROVERSY. Capitol Probe Series, mono 2677.

This hour-long documentary falls into two parts. Side 1 is concerned with the assassination of President Kennedy and the events surrounding it, and the subsequent murder of Lee Harvey Oswald. Side 2 looks at the findings of the Warren Commission and some of the ensuing controversy. The voice of Oswald's murderer, the ailing Jack Ruby, is heard on this side in a recording of execrable quality taken in his cell. The producer, Lawrence Schiller, however, has gone to great pains to contact and record the voices of people who had something important to say about what they saw on that fateful Friday morning on November 22nd, 1963 in Dallas, Texas.

I fully expected that a good deal of the emotion-laden material from broadcasts on the day would have been used but, instead, we hear the people concerned looking back from a distance of several years. Among them are the priest who administered the last rites to the dead President; the wife of Congressman Earle Cabell, who was in the motorcade; White House Press Secretary Malcolm Kilduff who remembers his feelings of apprehension before the Dallas visit; and Charles Brehm, who was standing with his young family within a few feet of the President's car when the bullets struck. Later on we hear Brehm again in a taped interview made in Dallas on the day of the assassination, as a deeply shocked onlooker.

This kind of thing is extremely effective documentary material when used as it is here. Further immediacy is given to Side 1 with the voice of Lee Harvey Oswald at a Press conference, and later the dramatic newscast where Oswald was shot before the TV cameras with his voice clearly heard just before the shot is fired. The somewhat breathy description by the commentator (if it is the genuine one on the day) sounds most odd, more as if he were re-enacting the scene using a peculiar verbal shorthand to describe what is happening — a la "Randy Stone" in "Nightbeat."

After the objective presentation of the facts on Side 1, part 2 is something of a shock because it is soon apparent that this is to be a less than objective look at the critics of the findings of the Warren Commission, especially Mark Lane, author of the book "Rush to Judgment." Mr Lane has also produced a long TV feature in which he makes out a very plausible case against the findings of the Warren Commission, and one of the most interesting aspects of listening to this record was hearing it within days of watching this actual TV film "Rush to Judgment" on local television.

The narrator on the record refers to this film as something "Lane has profitably distributed overseas," a somewhat unfortunate remark which makes one suspect that the producer has an axe to grind. In actual fact, the Lane theories are refuted on the disc in a much more effective way by independent speakers such as Professor W. J. Liebler, Assistant Counsel on the Warren Commission, and Congressman Ford, a member of the Commission.

Listening to the documentary at this distance from the United States, one learns with surprise that societies have sprung up all over America which sift and sift again all the available material relating to the Kennedy assassination. There is even one man who can cite chapter and verse of the Warren Report, others who correspond with each other over the most minute details.

As a piece of documentary making, "The Controversy" has been put together very well indeed. The narrator and the various speakers dovetail together most effectively and the voices are extremely well recorded in most cases. The only background music is provided by sparse use of a few chords struck on a guitar. It is a great pity that the narrator uses a special tone of voice when speaking of the critics of the Warren Report. I have always believed that the function of the narrator was to remain a little to one side of the emotional arena — interested, but taking no sides.

In spite of the bias revealed, this documentary has value in that it lets us hear eye witnesses recalling this historical event and others taking issue with the Warren Report but on the other hand we wonder whether there is much more to be gained from raking over the embers in further books, films and records. What really remains is the unchangeable fact that the death of President Kennedy was an "American Tragedy" of the first magnitude.

★ ★ ★

BEATRIX POTTER: "The Tale of Jemima Puddleduck." Cicely Courtneidge, Vivien Leigh and Company. Produced by Fiona Bentley. Songs and Music by Cyril Ornadel. Children's Record Guild of Australia (EP45) CG23. (Available from World Record Club.)

A performance to treasure on this little disc is given by Cicely Courtneidge as Jemima Puddleduck. Another one of Miss Potter's immortal creations from the animal world, Jemima Puddleduck is rather muddleheaded, and has a simple, trusting nature which leads her into some trouble with a certain Mr Fox. Miss Courtneidge in top form goes all out for something larger than life, in fact very much like the Cicely Courtneidge of old, on those marvellously funny records she made with the Hulbert brothers and others back in the 30s. (At least one of them, "Laughing Gas," is a classic of its kind.) Here, as Jemima, she reveals much of the old verve and vivacity.

Sparkling musical arrangements have been provided by Cyril Ornadel, and a strong supporting cast makes up the rest of the farmyard group who surround Jemima with help and advice. The late Vivien Leigh makes an easy to listen to narrator.

★ ★ ★

TOAD OF TOAD HALL from the play by A. A. Milne, adapted from "The Wind in the Willows" by Kenneth Grahame. Music by H. Fraser-Simpson. Children's Record Guild of Australia (EP45) CH-7. (Available from World Record Club.)

"Wind in the Willows" is, of course, one of the best loved of all children's books and on this record we have what is an entirely charming excerpt from A. A. Milne's play. The story here is concerned with Toad's mad desire to own a fast sports car, and being very rich he soon does, much to the confusion of everyone else on the highway. After being gaoled for his misdemeanours, he sets out with his friends Rat and Mole to reclaim Toad Hall which has been taken over by Stoats and Weasels. The interlopers are dislodged to the sound of "A-Walloping We Will Go" and some wonderful sound effects. The songs by H. Fraser-Simpson are all most infectious with a Gilbert and Sullivan air about them and, apart from a rather wobbly soprano at the beginning, are well sung.

A. A. Milne has made a wonderful job of turning the creatures of Kenneth Grahame's classic into stage characters, and the actors on this record relish their parts. A full-scale double LP set exists of the whole work, but this little disc will make a good start where the children of the house have so far not been exposed to the charms of "The Wind in the Willows." ■

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VARIETY FARE

"ELECTRONICS Australia" Staff Review Panel

Devotional

CHORUSES FROM THE MESSIAH (Handel). The Philharmonia Orchestra conducted By Otto Klemperer; The Philharmonia Chorus, Chorus Master Wilhelm Pitz, Organ, Ralph Downes; Harpsichord Continuo, Otto Freudenthal. Stereo, HMV OASD-2288. Also in mono OALP-2288.

Interest: As per title.
Performance: Of highest order.
Quality: Excellent.
Stereo: Normal.

This album is identified in the notes as having come from the complete HMV/Angel set, in 1965, which earned the remark by Rodger Fiske of "The Gramophone": "I am prepared to state positively that, on these records, the choruses are sung better than any other version."

The soloists' names from the same performance are retained on the cover but they are not heard as soloists anywhere in this album — Elisabeth Schwarzkopf, Grace Hoffman, Nicolai Gedda and Jerome Hines.

Without seeking to debate Rodger Fiske's firm opinion, based presumably on extensive listening, I have every reason to concede that it could be true. It is, indeed, a fine performance of choruses that will be familiar to all with an interest in classical or devotional music: And The Glory Of The Lord — And He Shall Purify — For Unto Us A Child Is Born — Glory To God — His Yoke Is Easy — Behold The Lamb Of God And His Stripes, All We Like Sheep — He Trusted In God — Lift Up Your Heads — Let Us Break Their Bonds Asunder — Hallelujah — Since By Man Came Death — Worthy Is The Lamb. Amen.

If the music appeals, you can buy with every confidence (W.N.W.).

★ ★ ★

I HEAR MUSIC. Stereo, Sacred (Gospel Film Ministry) LPS-4021.

Interest: Sacred's leading artists.
Performances: Top-line.
Quality: Good.
Stereo: Normal.

I often wonder why manufacturers don't release more records like this one — an album containing performances by fourteen of the leading artists under contract to Sacred Productions Inc. of Waco, Texas. In a sense, of course, it is a "sampler" but it is neither presented nor "ballyhooed" as such. It is presented in its own right as a concert of Sacred music. And an excellent concert it is:

Close To Thee (Ralph Carmichael Orchestra)—Pass Me Not (Bob Daniels, bass) — Standing In The Need Of Prayer (Sunday Sing Vocal Trio), — I Will Sing Of My Redeemer (Lorin Whitney, organ) — Anywhere With Jesus (Norman Nelson, tenor) — Cleanse Me (Wesley and Marylin Tuttle, vocal duettists) — Zion's Hill (Robert Bowman, baritone) — Near To the Heart Of God (Ralph Carmichael Singers) — God Will Take Care Of You (Alan McGill, baritone) — My Jesus I Love Thee (Bud Tutmarc, Hawaiian) — Battle Hymn (Beth Farnam, soprano) — Hallelujah, What A Saviour (Bob McGrath, tenor) — Revive Us Again (organ) — Saviour Like A Shepherd, Lead Us (Evangeline Carmichael, contralto).

A good one for your collection. (W.N.W.).

★ ★ ★

HAND IN HAND WITH JESUS. Skeeter Davis. Stereo, RCA LSP-3763. Also in mono LPM-3763.

Interest: Gently swinging Gospel.
Performance: Very smooth.
Quality: Above reproach.
Stereo: Normal.

In the jacket notes, written by the Pastor of the church with which she is a communicant, Rev. Robert Daugherty recalls the occasion when Skeeter Davis walked forward in a revival meeting and expressed her desire to walk "Hand In Hand With Jesus." This song, and those which follow, are presented as a witness to a faith which, he says, has remained firm through Skeeter Davis' years as a professional singer.

Recorded in RCA's Nashville studios, the whole presentation bears the stamp of the Nashville team — a gently swinging sound, with organ, piano, guitars, bass, percussion and chorus. In fact, it's one of those albums that should please old and young alike.

The titles: Hand In Hand With Jesus — It's Different Now — Do You Know My Jesus — No Tears In Heaven — Who Am I? — O Come, Angel Band — Precious Memories — I'll Meet You In The Morning — Child Of The King — Whispering Hope—How Beautiful Heaven Must Be—Won't Have To Cross Jordan Alone.

I liked it: I think you will, too. (W.N.W.).

★ ★ ★

FORTH IN THY NAME. Concordia Seminary Choir. Organist and Director, James Thiele. Stereo. DAVAN LRDS-001. Also available in mono LRD-001. Davan Recordings, 21 Ruthven Avenue, Magill, S.A.

Interest: Lutheran hymns.
Performance: Commendable.
Quality: Good.
Stereo: Modest.

"Davan" is a new label, this time emanating from South Australia. The proprieter, David H. Pfitzner, advises that interstate distribution has been arranged but the address is given above for those readers who may be unable to purchase the album through their normal supplier. As explained in the jacket notes, Concordia Seminary is a training centre for ministers and teachers of the Lutheran Church in Australia. As an essential part of their training, the students study church music and give their training practical expression in what here transpires to be a most excellent male choir.

Many of the hymns, quite unknown to me, are drawn from traditional sources and will appear, so the notes indicate, in a new Lutheran hymnal, soon to be issued. A sheet accompanying the album sets out the words in full and indicates authors, where known, the relevant dates and also identifies the tunes used, many of them dating back hundreds of years.

Interest therefore divides between the highly trained and responsive choir and music that, for the most part, predates the more usual run of Gospel hymns: Forth In Thy Name — Christ, Thou Strong Guardian—Psalm 46—A Mighty Fortress — I Will Sing My Maker's Praises—Psalm 150—For Ever With The Lord My Precious Saviour, Thee Desiring — Come, Holy Ghost, Our Souls Inspire — Rise, Children Of The Kingdom — At The Cross Her Station Keeping — Jesus Our Saviour, All of Joy The Giver — In Thee Is Gladness — Sun Of Righteousness Divine — Sing To The Lord Of The Harvest — Light Ever Gladsome.

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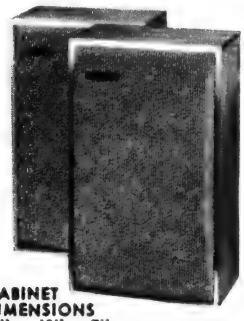

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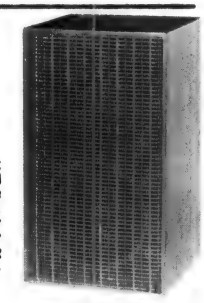

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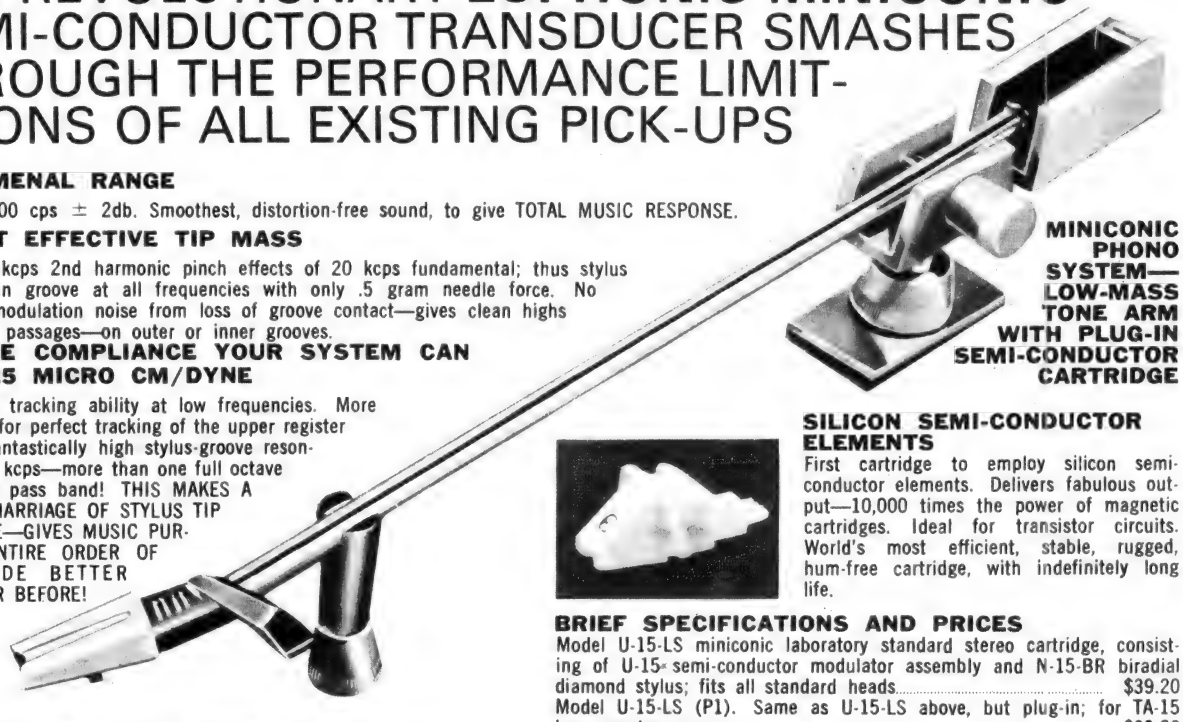

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TEST REPORT BY HIRSCH-HOUCK LABORATORIES in "ELECTRONICS WORLD" July—1965

FREQUENCY RESPONSE RANGE: "The frequency response was unusually flat and peak-free over the entire audio range—we would confirm Euphonics' claim of ± 2db. response from 20 to 20,000 cps."

TRACKING: "The cartridge tracked our high-level Cook and Fairchild records at only 1 gram of stylus force, matching or surpassing any other cartridge we have tested in this respect."

HUM: "If it is correctly installed, the Euphonics Miniconic is perhaps the most basically hum-free cartridge on the market."

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RCA32X.FPM

makes very pleasant and enjoyable light listening. And the technical side of the recording is of excellent quality, with negligible surface noise and distortion.

For lighter listening, recommended. (J.R.)

★ ★ ★

HEADS UP! The Baja Marimba Band. A. and M. Records (Festival) stereo SAML-932,299.

Interest: Marimba and Mariachi.
Performance: Smooth, relaxed.
Quality: Excellent.
Stereo: Good.

The guiding hand of Herb Alpert is evident in this slickly professional presentation of current hits a la Mariachi. The general style is reminiscent of the early Tijuana Brass, but with the marimba taking the lead role instead of trumpets. A. and M. Records is, of course, Herb Alpert's company, and he and his partner, Jerry Moss, produced this disc. With the mellow tones of the marimba dominating the melody line, the music flows smoothly along to produce a relaxing kind of entertainment which should be just the right kind of tonic after a hard day's work.

There are 11 tracks, entitled: Georgy Girl — Spanish Eyes — Winchester Cathedral — Domingo — The Odd One — They Call the Wind Maria — Born Free — Cabeza Arribe! — Temptation — Baja Nova — The Cry of the Wild Goose. As with all A. and M. releases to date, the technical quality is beyond reproach. (H.A.T.)

★ ★ ★

ADVENTURE. Ron Goodwin and his Orchestra. Columbia (E.M.I.) Studio 2 stereo SCXO 6091.

Interest: Light orchestral and film.
Performance: Rather robust.
Quality: Excellent.
Stereo: Excellent.

More film music—there has been a rash of this lately—but with a difference Much of it is composed by the conductor on this disc, Ron Goodwin, who appears to have almost a mortgage on this business in U.K., to judge by the imposing selection of titles for which he has contributed the scores. These include: 633 Squadron—The Trap—These Magnificent Men in Their Flying Machines — The Headless Horsemen — Of Human Bondage—Operation Crossbow. Included in this selection is the tune "Girl With a Dream" which Goodwin wrote as the signature tune for a popular radio show in U.K.; also included is the "Miss Marple's Theme" he wrote for the series of films featuring Agatha Christie's grey haired lady detective.

These all make quite pleasant listening, but the best is yet to come. The best track on the disc is, to my mind, the delightful "Elizabethan Serenade" of Ronald Binge, which I would unequivocally nominate as the best piece of light music composed in 30 years—unfortunately losing some of its delicacy here through the rather too robust performance. Then there is another very pleasing melody in "Girl from Corsica" written by Trevor Duncan several years ago, which seems destined to become a permanent part of the light music repertoire through the sheer charm of its theme. The two other tracks, both very good listening, are "Song of the High Seas," written by Richard Rogers for the "Victory at Sea" television series; and "Under the Linden Tree," a popular German song.

As mentioned above, the performances under Goodwin tend to be on the robust side, but this suits most of the tracks, especially Goodwin's own film music. This is an excellent collection of contemporary light music, and is brilliantly recorded in Columbia's Studio 2 process. (H.A.T.)

★ ★ ★

GREAT CATHEDRAL ORGAN SERIES (No. 10): HEREFORD CATHEDRAL. Organist Dr Melville Cook. HMV 12-inch stereo, CSDM 3565. (Also in mono, on MCLP 3565.)

Interest: Classical organ.
Performance: Very capable.
Recording: Excellent.
Stereo: Smooth.

This is the tenth in H.M.V.'s commendable series featuring the great cathedral organs, and presents the Willis-rebuilt instrument in Hereford Cathedral. The original instrument in this cathedral was a Renatus Harris built in 1686; it was almost completely rebuilt by Willis in 1892-3 to a specification drawn up by Willis and the then organist, Dr G. R. Sinclair. It now consists of four manuals CC to C, 61 notes, and a "Willis" pedalboard of CCC to F, 30 notes. Of a total of 104 registers, 65 are speaking stops. Tonally, the organ is in the best British tradition, with a strong diapason chorus and a somewhat dull pedal organ: There is the expected "Double Open Wood, 32ft," a heavily blown "Bombard, 32ft," seven assorted 16ft stops, three 8ft and a single 4ft stop "Octava Flute." Mercifully any of the manuals can be coupled up to the pedal.

Despite these slightly derogatory remarks, the instrument is, of course, a large and versatile one, and capable of an impressive performance. And its capabilities are probably shown off fairly well in this 1966-recorded recital by the then-organist, who seems a formal

For Steam Loco Enthusiasts

HELPER SERVICE. Steam Action Volume 3. Mono, W. & G. WG-B-5051.

Interest: Australia's steam locos.
Performance: The real thing.
Quality: Some lack in upper register.

As a lad in the country, my bedroom was less than 50yds from the peak of a long haul on the main Sydney-Melbourne line. Through the night, trains would toil up the grade, stop for water, then fight to get moving again, with wheels spinning on the frosted rails. In five years of travelling to secondary school, I chalked up over 100,000 miles behind those same locos.

Nowadays on those and most other tracks, steam has given over completely to diesel or electric—powerful, efficient but prosaic. However, thanks to W. & G. engineers, you can have the old-time steamers right in your loungeroom and, if this sounds a trite phrase, just put this album on and turn the lights down and the wicks up!

Most of the sound pictures were recorded on the Tumulla gradient on the main N.S.W. western line to Broken Hill, between Bathurst and Orange. The title "Helper Service" comes from the practice of using multiple locos on the 1-in-40 grade, the "helper," in many cases simply pushing at the rear. The loco types, 50, 53, 54, 36, 38, 60 will be most familiar to N.S.W. residents but the sound of steam is universal. In any case, Victoria and South Australia are represented in the last two tracks.

The sounds are all well recorded, my only criticism being that the system just hasn't been wide enough to capture the ear-splitting hiss of escaping steam—"white noise" in the truest sense of the term. But don't let that stop you from hearing the record. For steam train enthusiasts it will be a "must." (W.N.W.)

THE WHARFEDALE Linton

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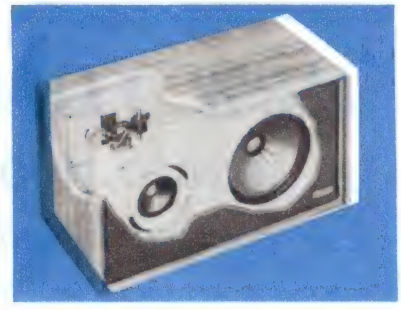
Make your choice from selected mahogany, teak and walnut veneers. Finish is quite impeccable; the price of the Linton is only $89.50. See and hear this popular Wharfedale enclosure at all reputable audio stores.

*British Board of Trade statistics.



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though very capable player. My only real reservation is that there are no baroque works to demonstrate the instrument's capabilities in that direction. The pieces played, apart from John Bull's delightful little "Pavana and Sinfoniae," are of the Romantic and Modern schools: there is Samuel Wesley's well-known "Larghetto in F Sharp Minor," Jongen's somewhat pretentious "Sonata Eroica," Langlais' "Incantation pour un jour saint," Flor Peeters' contemplative "Aria" (Op. 51), and Maurice Durufle's "Prelude et Fugue sur le nom d'Alain" (Op. 7).

Technically, the recording is of excellent quality, although I think it would have benefited from a slightly higher recording level. The stereo is smooth and unobtrusive.

For organ lovers, particularly collectors and those with a leaning toward the Romantic and contemporary schools. (J.R.)

★ ★ ★

SHADOWS IN LATIN. Norrie Paramor and his Orchestra. Stereo, Columbia (EMI) SCX0 6012.

Interest: The Shadows' music.
Performance: Bright, colourful.
Quality: Very good.
Stereo: Emphasised.

As a tribute to the British instrumental group, The Shadows, their recording manager (Norrie Paramor), and his orchestra have recorded the following well-known Shadows' tunes: Side 1, Dance On—Atlantis—Foot Tapper—Nivram—F.B.I.—Guitar Tango—Peace Pipe. Side 2, The Rise And Fall Of Flingle Bunt—Wonderful Land—Shindig—Little Princess—Stars Fell On Stockton—Apache—The Frightened City. The flavour is distinctly latin as the title would suggest. Recommended, for Shadows' fans and others. (A.J.L.)

★ ★ ★

MORE COMMAND STEREO SPECTACULAR. Enoch Light and orchestra with Tony Mottola, Lee Evans, Doc. Severinson and Command All Stars. Stereo, Universal Record Club SU-836.

Interest: Stereo.
Performance: Flamboyant.
Quality: Excellent.
Stereo: Exploited.

Here's another recording in the traditional Enoch Light style. All through the arrangements are bright and imaginative, though some may feel that treatment is carried to the point where the result approximates a stereo demonstration disc. The tracks are: Side 1, Just The Gypsy In My Soul — On The Street Where You Live—Riders In The Sky—I'm Over Here—Love For Sale—Tip Toe Through The Tulips. Side 2, Watermelon Man — Bye Bye Blues — Theme From "Black Orpheus"—Just One Of Those Things—Walk Right In — Downtown. The recording is excellent, with low noise and distortion, thanks to Command's use of a 35mm magnetic film master. Recommended for light entertainment. (A.J.L.)

A PIANO RECITAL by Moura Lympany. World Record Club stereo S/T4284.

Interest: Piano classics.
Performance: Rather cool.
Quality: Very good.
Stereo: No noticeable spread.

There is a pleasing variety in this selection of popular piano classics, but all the works are from the Romantic period, except one. The exception is Poulenc's "Pastourelle," which looks back to the Romantics even if it was composed this century. The selection comprises: Claire de Lune (Debussy) — Valse Impromptu (Liszt) — Preludes in A major and C minor (Chopin) — The Maiden and the Nightingale (Granados) — Capriccio in F minor (Dohnanyi) — Waltz in A flat (Chopin) — Tango in D (Albeniz) — Pastourelle (Poulenc) — The Prophet Bird (Schumann) — Intermezzo in B flat minor (Brahms) — Study in C sharp minor (Chopin).

Miss Lympany's approach to these works is rather cool, and her choice of tempos moderate. I cannot remember hearing the C sharp minor study of Chopin played as leisurely as this. However, nearly all the remaining pieces call for slow or moderate tempos (which probably accounts for their popularity among amateur pianists), so the above remarks should not be taken as adverse criticism. The technical quality of the disc is good, with no noticeable distortion and quiet surface. (H.A.T.)

★ ★ ★

THE MORTIER DANCE HALL ORGAN, presented by David Barlow. Stereo, Columbia "Studio 2" SCX0-1778. Also in mono 330SX-1778.

Interest: Old mechanical organ.
Performance: Mechanical.
Quality: Good.
Stereo: Modest.

Some months ago I reviewed "Dance To The Mortier Organ" on Decca SKL-4789; here's another one on Columbia, recorded on a similar instrument, but apparently not the same one. A development of the original "barrel organ" concept, these Mortier instruments, built in Belgium around 1937-38, are operated by a pneumatic system not unlike that developed for player pianos. They varied in size from portable to transportable

A BATCH OF 45rpm EP's

GREAT ORGAN FAVOURITES. Reginald Dixon at the organ of the Tower Ballroom, Blackpool. Mono, Columbia SEGO-8507. In his inimitable style, the seemingly timeless Reginald Dixon plays four of the traditional "classics" of the cinema organ: Sanum — Rustle of Spring — Trumpet Voluntary — Intermezzo from Cavalleria Rusticana. The sound quality is good but free use of vibrato makes it strictly a disc for Wurlitzer fans. (W.N.W.)

THE MAN ON THE FLYING TRAPEZE. Spike Jones. Mono, Gold Star Series EPA-580. Who can forget the crazy sounds of Spike Jones and his crew? You've forgotten? Really? Then you'd better get hold of this re-release which contains four excellent specimens: The Man On The Flying Trapeze — None But The Lonely Heart — My Old Flame — The Glow Worm. Despite the passage of years, the sound is still good. (W.N.W.)

LIFE GETS TEE-JUS. Archie Campbell. Mono, RCA 20413. Pleasant voiced Archie Campbell resurrects the old hillbilly monologue "Life Gets Tee-jus, Don't It?" followed by a spirited account of that famous feud "The Martins And The Coys." The two on the back are little more than appropriate encores: "I'm Goin' Back To Whur I Came From" and "The New Marriage Ceremony." Sound quality is good. (W.N.W.)

PETER NERO PLAYS. Mono, RCA 20396. Battling it out with an unnamed orchestra, pianist Peter Nero, on side 1, plays a fairly restrained "Born Free" and "Who's Afraid." This is followed on side 2 with highly hotted up versions of "Battle Hymn Of The Republic" and "The Best Thing For You." The quality is fair only — plenty of level, not too clean and with a trace of wow. Not for me! (W.N.W.)

DAY-O. Harry Belafonte. Mono, RCA Gold Standard Series EPA-5138. Four songs which represent well the art of Harry Belafonte have been assembled by RCA on this disc: Day-o — Venezuela — Scratch, Scratch — Star-O. The quality and noise level betray the age of the performances to a minor degree but not enough to deter anyone with an interest in this very capable artist. (W.N.W.)

and were intended to be used in continental dance halls and fairs.

On the Decca disc the organ churns out period pops in a constant stream, interrupted only by the label and with a sound strongly reminiscent of a fairground steam organ.

On this new Columbia release, there are 12 distinct selections, arranged and voiced to sound rather more like a cinema-style performance. However, while it is different in this respect, like the earlier record, its appeal will be more on the grounds of novelty than anything else. The recording itself is good — and it needs to be — because the pipes and the "full range of percussion" are exploited pretty fully.

The track titles: Blaze Away—Colonel Bogey—Entry Of The Gladiators—Waltz Of The Flowers—Wine, Women And Song — Poet And Peasant Overture — Baum — Wooden Heart — Song From Moulin Rouge — Buona Sera — Wonderful Copenhagen — Pop Tune Selection.

Worth a hearing if you have nothing else like it. (W.N.W.)

★ ★ ★

INTIMATE EXCITEMENT. Vikki Carr, with orchestra. Liberty (Festival) stereo SLYL-932,302. Available in mono.

Interest: Very popular singer.
Performance: Intimate and exciting.
Quality: Excellent.
Stereo: Normal.

Vikki Carr is an extremely popular singer, and it is easy to see why — she radiates warmth and sincerity even via the medium of a gramophone disc. I imagine to be actually present at one of her performances must be quite an experience. In addition to this gift for communication, she possesses an unerring sense for rhythm and phrasing which is obviously based on first class musicianship. If you are one of her fans, this disc has everything you would wish to find in one of her performances — a good selection of tunes apparently chosen to avoid the overplayed "Top 40" numbers, skilful arrangements well played by a good supporting orchestra and excellent sound and stereo, as well as a faultless execution by Miss Carr.

Titles are: Laia Ladaia — Goin' Out of My Head — Toys — Meditation — Pretty Butterfly — Carnival —Mas Que Nada — Call Me — Once — The Constant Rain — Forgetting You. (H. A. T.)

★ ★ ★

FAIR AND TENDER — Tina Lawton, vocal, with Don Burrows, flute, George Golla, guitar, Lal Kuring, cello, and Herbie Marks on virginals and piano accordion. CBS 12-inch mono B.P. 233394.

Interest: Folk ballads.
Performance: Tender indeed . . .
Recording: Excellent.

Another delightful recording from well-known Australian folk singer Tina Lawton, who will probably be best remembered by many from her impressive appearance in the ABC-TV program "The Restless Years." This time she is singing well-known romantic folk ballads, and as usual she makes most entrancing listening indeed. The fresh arrangements are by successful Australian arranger Don Burrows, who also plays flute in some of the accompaniments.

The songs presented are: Courting in

the Kitchen — Lassie Wi' the Yellow Coatie — The Stuttering Lovers — Lady Mary — I'll Tell My Ma — Ho-Ro My Nut Brown Maiden — The Butcher Boy — Three Lovely Lasses from Banyo —Come All Ye Fair and Tender Ladies —Raggle-Taggle Gypsies Oh! — Greensleeves — Coulter's Candy — Mary Hamilton.

The recording is of excellent quality, and the disc can be warmly commended — particularly to folk lovers. (J. R.)

★ ★ ★

BURL IVES' GREATEST HITS. Burl Ives, with various orchestras and choruses. Decca, U.S.A. (Festival) stereo SDL932251. Also available in mono.

Interest: Career highlights.
Performance: Great.
Quality: Varies.
Stereo: Mostly simulated.

There will be few who are not familiar with the jovial voice of Burl Ives singing the folk songs and ballads of the American countryside. During the past 20 years he has built up a wide following of devotees in pretty well every English-speaking country. Now Decca Records (U.S.A.) has made a selection of 12 numbers which they judge to have had the greatest public appeal during his long career as an entertainer. These are: A Little Bitty Tear—True Love Goes On and On — Call Me Mr In-Between — Cool Water — Foggy, Foggy Dew — Goober Peas — Pearly Shells — Funny Way of Laughing — This is All I Ask — My Gal Sal — That's My Heart Strings — Blue Tail Fly.

While you may or may not agree with this choice of numbers as Burl's "Greatest Hits," the fact remains that these tracks represent highlights from the career of a master entertainer and, if you are a Burl Ives fan, you should not miss this one. As with all discs of this type, incorporating a number of recordings made over a long period, the sound quality varies, but is never less than adequate. (H.A.T.)

BRIEFLY . . .

BRILLIANT OVERTURES — Vienna State Opera Orchestra, conducted by Hans Swarowsky. Concert-Hall "Synchro-stereo" 12-inch stereo/mono, SMS 2441.

A pleasant little disc of "brilliant," albeit mostly less than well-known, operatic overtures. Hans Swarowsky and the V.S.O.O. play the overtures to Berlioz' "Roman Carnival," of Fenbach's "Orpheus In The Underworld," Cherubini's "Anacreon," Lortzing's "Czar and Carpenter," and Weber's "Precioca." The playing is sprightly and warm, and the technical side of the recording is very good. (J.R.)

THE BEST OF ARTHUR FIEDLER AND THE BOSTON POPS. Popular orchestral. RCA 12-inch stereo, LSC-2810. (Also in mono, on LM-2810.)

A new recording of evergreen popular and middle brow music by Arthur Fiedler and the famous Boston Pops orchestra. It includes their popular renditions of "I Want To Hold Your Hand" and "Hello, Dolly!" previously not available on LP. The other tracks are: Jalousie—On The Trail — More — The Glow Worm — The Yellow Rose of Texas—Prayer of Thanksgiving — Mack the Knife — Warsaw Concerto — Blue

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Read the review of the SAU-2 tone arm and the Connoisseur Classic turntable in "Hi-Fi News", May, 1967, p. 133-5.
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Regarded as the finest ceramic stereo cartridge produced anywhere in the world, the Connoisseur SCU-1 will load any normal amplifier or tape recorder. Tip mass is 1 milligram, vertical compliance 8 x 10-6 cms-dyne, lateral compliance 12 x 10-6 cms/dyne. Sound qualities are exceptional—and include a pleasant musical transparency. Ask for copies of reviews in the "Gramophone" and "Records and Recording". **Encel price** **$10.80**
STOP PRESS: Stocks of 78 styli are now available for the Connoisseur SCU-1 stereo cartridge.

CONNOISSEUR CRAFTSMAN III TURNTABLE

Perfection in a precision 3 speed transcription turntable is the only way to describe the Craftsman III. Fitted with a 12" non-ferrous lathe turned turntable and a hysteresis synchronous motor . . . and a built-in illuminated stroboscope. Speed variation of 8% may be made. See the reviews in "Gramophone" and "Hi-Fi News" or write for your own personal copy. **Encel price** **$67.50**

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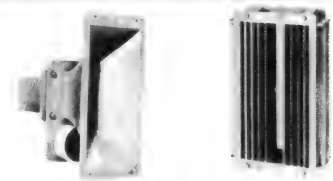

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This 12" woofer is the model used in the Kardioid enclosure; total flux is 250,000 maxwells due to use of a new ceramic ring magnet of "Magnadur 2". Frequency response is 30-5000 Hz. and the recommended crossover frequency is 2500 Hz. The voice coil is embedded in polyester resin — transient peaks of 100 watts will not damage the assembly. Normal power rating is 35 watts R.M.S. **Encel price** **$48.50**

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Tango — National Emblem March. The playing is in the best Boston Pops tradition, and the recording is fine. (J.R.)

RETURN OF THE SEVEN and other themes. Al Caiola, guitar, with orchestra. — United Artists (Festival) stereo SUAL-932,290. Available in mono.

Eleven themes from films, stage shows and TV series, played in his typical one-string style by popular guitarist Al Caiola, with excellent orchestral support: Return of the Seven—The Sand Pebbles—The Spies—Penelope—When the Day is Done—Strangers in the Night—Rat Patrol—Maya—Cast a Giant Shadow—The Flame and the Fire—Duel at Diablo. Technical quality and stereo are first class. (H.A.T.)

GREAT COUNTRY SONGS. Don Gibson, with vocal accompaniment by The Jordanaires. RCA Dynagroove stereo LSP-3680. Available in mono.

Don Gibson gasps, grunts and moans his way through a round dozen of his own songs and in doing so proves that he is a better song writer than a singer. He appears to be swinging over his style from Jim Reeves to Bob Dylan, but is caught in between at present. Titles include A Born Loser, Lost Highway, When I Stop Dreaming, You Can Laugh. Excellent sound and stereo. (H.A.T.)

SOVIET ARMY CHORUS AND BAND, conducted by Colonel Boris Alexandrov. Columbia 12-inch stereo, SAXO 7500. (Also in mono, on 330CX 7500.)

An entertaining recording of Russian, English and Ukrainian folk songs by the chorus and band of the famous Soviet Army Ensemble, apparently recorded during its recent visit to London. With zest and warmth they sing: Song of Youth — A Birch Tree in a Field Did Stand — Far Away — Volga Boat Song — You Are Always Beautiful—Along Peter's Street — Tipperary — Kalinka — Bandura — Oh, No! John—Snow Flakes — Ukrainian Poem — Soldier's Chorus. The recording seems a little light in terms of bass, but is otherwise quite good. (J.R.)

COCKTAIL TIME WITH FRANKIE CARLE. Camden (RCA) stereo CAS-2118.

Very pleasant presentation by the king of cocktail pianists, Frankie Carle, of favourite tunes of the last three decades, plus a couple of his own compositions (A Lover's Lullaby and Sunrise Serenade.) Frankie's fluent and smooth playing style is backed by an excellent rhythm section. Ten tracks, including Blue Tango, Wish You Were Here, Auf Wiedersehn Sweetheart, Two Hearts in Three-quarter Time. Although released on the Camden label, this appears to be a new recording, with excellent sound and stereo. (H.A.T.)

DINA LATINO — Dean Martin, vocal, with arrangements and conducting by Don Costa. Reprise 12-inch stereo, RS 6054.

Latest release by popular singer and TV personality Dean Martin is this collection of favourite Latin ballads. The tunes are well arranged, the singing is in the best Dino "relaxed" tradition, and the whole makes very entertaining listening. The tracks are: El Rancho Grande — Manana — Tangerine — South of the Border — In A Little Spanish Town — What A Difference A Day Makes — Always In My Heart —Besame Mucho — La Paloma. The recording is of excellent technical quality. (J.R.)

Graeme Bell Says . . .

ON THE SUNNY SIDE OF THE STREET. The Jonah Jones Quartet. Festival Records. Stereo SDL-931,854. Also on Mono.

Interest: Jazz trumpet.
Performance: Warm and Professional.
Quality: Lively.
Stereo: Unimportant.

Jonah Jones had been going for many years when he decided to front a rhythm section and make a comeback with what —at that time—was a rather unusual combination, viz.: trumpet with piano, bass and drums. This idea of his rocketed him to world-wide fame, and now at many a session you can hear musicians say "Let's do a Jonah Jones"—meaning a quartet comprising trumpet and rhythm.

He has some top men with him on this most enjoyable LP, but I don't think any of them were with him when he toured Australia. Hank Jones on piano and Ossie Johnson on drums are musicians of great renown, and bassist John Brown was part of Jonah's original quartet. This is a collection of 12 old tunes, all of which swing, and Jonah sings on three of them.

★ ★ ★

DOC SEVERINSEN AND FRIENDS. Swinging and Singing. Command (Festival) stereo SNDL-932,238. Also on mono.

Interest: Trumpet brilliance.
Performance: Fluent.
Quality: Superior.
Stereo: Realistic.

Little heard of a few years ago in this country, Doc Severinsen's trumpet prowess is now firmly established as a result of his many appearances on recent issues of Command Records. Pianist Dick Hyman is responsible for the arrangements on this album and uses a 12-voice vocal group, percussion, guitars and rhythm section to support Doc's flowing trumpet and flugelhorn.

Severinsen is a studio, symphonic and jazz musician all rolled into one, and displays a thorough knowledge of all the different styles of today and yesterday with a technique which leaves nothing to be desired. But for my money highest marks once again go to Command Records for fantastic reproduction.

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GE:P385

STAN KENTON PLAYS FOR TODAY. Capitol, mono, T2655. Also on stereo.

Interest: Brass.
Performance: Musicianly.
Quality: Good.

Here on this album Kenton has come up with some clever arranging for five trumpets and a lot of percussion, plus rhythm section of bass, drums and piano. All of the tunes are treated with strong Latin rhythm, even in those cases where the original form was a straight four beat.

The writing for the brass in Lennon and McCartney's "Yesterday" is particularly beautiful, but I find much of the nostalgia of the same composers' "Michelle" lost in a welter of high note close harmony. "Never On Sunday" has a new twist to the interlude, and in "Lara's Theme" Kenton drops eight bars, apparently thinking that its repetition was monotonous. Other titles include "Strangers In The Night," "Sabre Dance" and "The Sound of Music."

★ ★ ★

A SIGN OF THE TIMES. Les Brown and His Band of Renown. Festival, stereo SDL932061. Also on Mono.

Interest: Good contemporary tunes.
Performance: Restrained.
Quality: Slightly muddy.
Stereo: Normal.

Those still too young to remember the wonderful big band of the old days led by Les Brown will at least know of him today because of his important association with Dean Martin on the latter's internationally known TV Show. He has chosen for this album material of contemporary appeal, and presented it in a relaxed and pleasant manner. "Strangers In The Night," "Call Me" and "It's Not Unusual" are all there—they are just about on every big band record you pick up these days.

With a Latin flavour are five tunes by Latin composers, including A. C. Jobim, who are having a very good run at the moment. They include "Little Boat," "Meditation," "Quiet Nights" and "How Insensitive."

★ ★ ★

FATS WALLER And His Rhythm. RCA Gold Star Standard Series 45 EP EPA-5140.

Interest: Fats Waller.
Performance: Bubbling.
Quality: Good remaster.

Here's yet another excellent Gold Star Standard Series from RCA's seemingly inexhaustible supply of Fats Waller recordings. He made over 500 titles in his short recording life, so we have a long way to go yet. As usual, Fats is full of fun on this EP, and the titles are among the most popular from this talented pianist-entertainer, who died at the age of 39 in 1943: "Your Feet's Too Big," "It's A Sin To Tell A Lie," "The Joint Is Jumpin'." "I'm Gonna Sit Right Down And Write Myself A Letter."

AUSTRALIAN JAZZ . . .

RED ONIONS BIG BAND MEMORIES. W. & G. Mono — WG 25/5065.

Instead of the paths of Melbourne and Sydney jazz gradually converging as time goes on, they are just as separate as they were 20 years ago. The main reason for this is that whereas the Sydney amateurs go back to the roots of New Orleans jazz the Melbourne boys go back to the roots of Melbourne jazz. And the roots of Melbourne jazz, which were established by the Bell band, Frank Johnson and later the Barnards, sprang from Oliver, Jelly Roll and Lou Watters, with the latter mainly concentrating on the Armstrong Hot Five.

Almost without exception everybody then climbed on to the early big band kick, and many of the numbers of this album inspired by Armstrong, Ellington and Luis Russell, etc., were performed by my own original band in England in the late 40s. It was this which kicked off Humphrey Lyttelton into following the same path.

The Red Onions are without a doubt the hottest and most colourful band playing in the traditional manner in Australia today, although at the time of writing they are on their way to Europe to seek their fortune. It's a pity Sydney hasn't got a band like this among the amateurs. The Sydneysiders are keen as mustard on "having a blow," but lack discipline and technique. Which boils down to the fact that they don't practise nearly as much as the Melbourne boys.

Titles on this album include "Jersey Lightning" with William Morris doing Pops Foster on what looks like a double B flat tuba in the cover photo. Ellington's "East St. Louis Toodle-oo" is tightly arranged and Waller's "Crazy 'Bout My Baby" gets an unusually fast treatment. All the tracks are good and the arranging is excellent. With the invaluable experience which an overseas trip will give these boys they should be a sensation when they return to Australia.

Incidentally, in further support of my theory of "the Melbourne influence" listen to the gravel-voiced scat singing—it is more like Ade Monsbourgh than Louis!

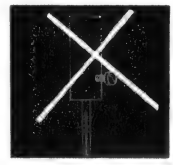
★ ★ ★

TRAD JAZZ, with The Ballarat Jazz Messengers. W. & G. Records 45 EP Mono WG-E.2737.

Ballarat is famous for its South Street Competition and among the entrants to this famous annual event have sprung world-famous singers and instrumentalists. Now we have a jazz band from this icy-cold Victorian city playing warm and happy jazz with a competence usually associated with the professional jazz bands of Sydney and Melbourne. Mal Jennings, trumpet and leader, is without a doubt a successor to Bob Barnard and the only thing which could prevent his complete fulfilment of this role is the appalling lack of jazz opportunities in this country. He has something new to say on "New Orleans" and plays a driving lead on "Original Dixieland One-Step." The remaining tunes are "My Old Man" and "Swingin' Safari." All arrangements are interesting and harmonically sound.

W & G are to be congratulated for their fostering of young Australian jazz musicians—which is more than can be said for any of the Sydney companies—and we look forward to an LP in the near future from this young Ballarat group.

"RODAN" ONE PLANE READ OUT.



"MODENA" SOLDERLESS PLUGS AND SOCKETS

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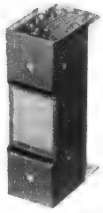
"SIGNALITE" NEON LAMP RESISTORS

"MINI-LAMPS" LOW VOLTAGE INDICATORS



"RODAN" RKEI READ OUT.

"RODAN" MOSAIC READ OUTS.

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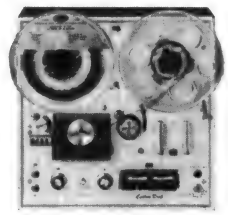

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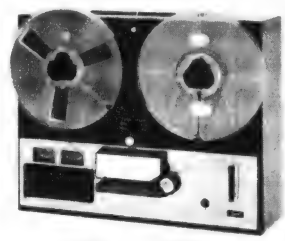

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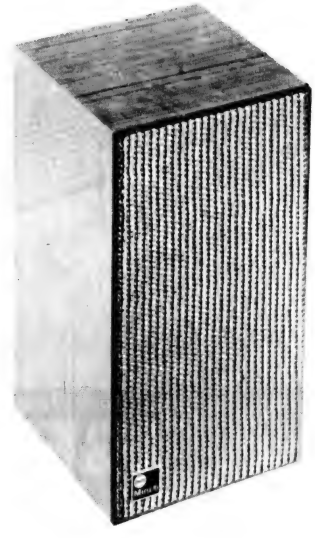
TRADE REVIEWS AND RELEASES

THE MINI-FI LOUDSPEAKER SYSTEM

Of special interest in the context of domestic high fidelity sound is the recent release, by the Rola Division of Plessey Components, Australia, of their new "Mini-fi" loudspeaker system. It combines wide frequency range and high power handling capacity with very modest dimensions.

Actual dimensions of the system are 14 x 8 x 8 inches. The units supplied for our inspection were finished in a medium oiled teak veneer, with a tasteful fret cloth woven from buff, brown and gold filaments. The back is glued in position and finished in dull black, access to the system being through the front, by popping out the fret panel. Delivered, properly packaged in its own cardboard carton, one's immediate impression is of a product well finished and well presented.

The enclosure is of the fully sealed variety, a technique popularised in this country by our own build-it-yourself "Playmaster Bookshelf" system. However, whereas the Playmaster unit system, of necessity, had to be designed around a fairly conventional 6-inch wide-range loudspeaker, serving as the woofer, Rola engineers have produced a special 6-inch woofer having a very low cone resonance and intended to operate with substantial air-loading on the rear of the cone. Designated as type C65-O, the new woofer features a neoprene rim suspension for the edge of the cone, a 4-inch diameter open-weave "spider" to support the voice coil and a voice coil/magnet system designed to permit long travel with a minimum of non-linearity.



The published data suggests that the free-air resonance of the C65-O is 25Hz but, in our laboratory, a normal free-air check of impedance failed to reveal any sign of a resonance within the range of our generator, which goes down to 18Hz. Mounted in the enclosure, however, the resonance was measured at 82Hz for one unit and 85Hz for the other. Air space in the box, by the way, is substantially occupied by a very light filling material, wool-like in its appearance and to the touch.

The system resonance of 85Hz is interesting in that it is of the same order as attained in our Playmaster Bookshelf system, though Plessey/Rola engineers have managed to achieve it with a much smaller enclosure, by reason of the specially designed woofer. Not counting intrusions into the enclosure, the actual internal dimensions of 13 x 7 x 6¼ inches give an enclosed volume of 0.34 cu. ft against about 0.54 cu. ft for the Playmaster unit. With their similar cone piston areas and similar resonances and mounted in filled and sealed boxes, the two systems actually produce much the same behaviour — and sound — over the bass register. Both are substantially level to below 80Hz and both slope smoothly downwards towards 40Hz. Both should be used with partial boost for best balance, secure in the knowledge that, within the limits of linear cone excursion, the sealed enclosure will inhibit the doubling and tripling effects which can flow from a vent port.

For the Playmaster Bookshelf system, we had to be cautious in mentioning power handling capacity because data were not available for the specified woofer under sealed enclosure conditions. We simply had to express an opinion, based on experience, that the system would operate safely and efficiently with the average 10 — 10 watt stereo amplifier. For the Mini-fi system, the makers quote 15 watts as the power handling capacity and this should be ample to cope with good quality stereo amplifiers used in the average domestic situation — even where the listeners like plenty of volume.

A significant point is that some compact systems are credited with substantial power handling capacity but only, in part, because they also exhibit low sensitivity; substantial power input is necessary to produce reasonable acoustic output! This accusation cannot be levelled against the Mini-fi unit. While some penalty has to be paid in terms of sensitivity for the long-travel voice coil system, the loss is substantially offset in the C65-O woofer by the use of a 70oz ferrite magnet, giving a flux density in the air gap of 12,500 gauss. Thus, while the sensitivity may be somewhat below that of the larger high fidelity loudspeakers, the difference will certainly not be sufficient to cause any problems with normal high performance stereo amplifier systems. The manufacturers claim that it can be used with low power amplifiers, if desired, but such amplifiers would have nothing to spare for bass boost.

So much for the bass characteristic and the general sensitivity. What of the response over the rest of the frequency range?

According to the literature, the C65-O has been designed to exhibit a sharp acoustic cut-off at 5KHz with the express intention of eliminating the need for a series inductor and minimising phase shift which might be introduced thereby. The high frequency range is looked after by a 5FX tweeter, as used in our original Playmaster Bookshelf system. This is coupled, to the drive in the Mini-fi unit, by a 1uF capacitor.

The overall effect is a response plateau which is substantially flat to about 3.5MHz. It would then appear to slope downwards to a trough centred on 5 to 6KHz, the response rising to reference again at 9KHz and beyond.

On some program material the effect of this trough is quite noticeable—and one we did not like—on A-B tests with other systems having more output in this critical area. Orchestral strings and the small pipes of acoustic organs recede into the too-prominent middles and, while the response comes up again in the 9KHz region, it is too far removed from the essential musical register to save the day.

The reason for this is rather hard to fathom. It could have something to do with the choice of tweeter coupling capacitor or the decision not to use a series inductor to the woofer; while the woofer may exhibit a mechanical cut-off, it will probably still absorb power at high frequencies. But, whatever the reason, we feel that the manufacturers would be wise to analyse the response—and the sound—in this critical region. At this early stage it should fortunately be possible for the manufacturers to effect refinements in the final production models.

In making these remarks, we do not mean to deny the ability of the Mini-fi system to produce some very enjoyable sound. When we heard it at the I.R.E.E. Convention in May, we were tremendously impressed by the big sound from the little enclosure. But, equally, when we set it up, first in the home and then again in our lab., we could not help but express a subjective wish for a little more brightness and a little better definition. If the designers can overcome this reservation, which was shared by all who heard the two prototypes which we had, they will have a real winner.

We understand that supplies of these speaker systems are not yet available for general distribution, and we have no information on price. Inquiries relating to availability and price should be addressed to Rola Company (Australia) Pty. Ltd., The Boulevarde, Richmond, Victoria 3121; or Christina Road, Villawood, New South Wales 2163. A four-page brochure describing the system is also available from Rola offices on request.

Incidentally I should perhaps mention that the Mini-fi is to be sold only as a complete system. It is not available as a kit, nor is the C65-O woofer being sold separately. (W.N.W.) ■

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HARMAN KARDON RECEIVER/AMPLIFIER MODEL 210

A Harman Kardon "Nocturne" model 210 stereo receiver, as illustrated, was submitted for review by Messrs. Recorded Music Salon, of 23 Collins St., Melbourne, Victoria. It is an all-transistor design, equipped to receive AM radio, FM and FM/stereo, and to operate in conjunction with magnetic pickup and tape facilities.

Overall dimensions of the unit are 14¾ inches wide, 4¼ inches high and 14 inches deep. It is styled either for shelf mounting or for installation in a cabinet, assuming provision in each case for adequate ventilation. The front panel is tastefully finished in translucent black, with gold lettering and matte gold trim. When the equipment is switched on, the panel lights up to reveal the calibrated AM/FM tuning scales and tuning meter.

Accessibility appears to have been a prime consideration in the design of the unit; this is in marked contrast to some other amplifiers which have been submitted for review, where all the components have been packed quite densely into the available space. Five printed boards are used, in addition to one for the FM tuner, mounted horizontally and held in place by spring clips. This ensures easy access to the circuitry for possible service, while the system is in operation.

The "receiver" circuitry provides for reception of FM, FM/Stereo and AM. Unfortunately, the FM facility is not likely to be of much use in this country although we did tune TV channel 4 at around 101 MHz. The AM tuner is of average sensitivity, operating from a ferrite rod antenna fitted at the rear of the chassis. A D'arsonval tuning meter facilitates "spot-on" tuning of all stations.

As supplied, the amplifier has a two-core power cord and is suitable for operation from 117 or 240 volts AC. A switch to select the operating voltage is mounted inside the chassis, next to the power transformer. A two-pin AC "accessory" outlet on the rear of the chassis is controlled by the amplifier's own power switch.

Inputs are provided for magnetic cartridge and high level tape. There is no specific provision for a ceramic cartridge and those wishing to use one would have to provide a suitable compensating network to simulate magnetic cartridge characteristics.

Terminals are provided on the rear of the chassis for two sets of loud speaker systems, either or both of which may be selected by rocker switches on the front panel. Terminals are also provided for an outdoor AM antenna and a 300-ohm FM antenna. A headphone jack is fitted on the front panel, which can be used in conjunction with, or without, the loudspeakers.

Controls are as follows: Three rocker switches, for tape monitor and the two speaker systems; volume control with integral power switch; bass control; treble controls; balance; selector switch; tuning knob for FM and AM. The selector switch has six positions for selection of FM, FM/stereo, AM, magnetic cartridge in mono or stereo mode, and input from a tape deck. The tape monitor rocker switch overrules the selector switch as far as the loudspeaker output is concerned and enables playback from the replay heads of a tape deck while in the process of recording.

The control knobs are of rather small radius but they have a smooth and positive "feel". The tuning knob is fly-wheel assisted for a smooth "action".

Associated with the volume control is circuitry which provides 9dB of boost at 100Hz when the control is in the 9 o'clock position. This contour for low-level listening is "defeated" by a pull-on switch associated with the normal bass-boost control.

The tone controls are specified to give plus or minus 12dB "bass" and "treble" boost and cut, but the frequencies at which this order of boost and cut is to be achieved are not stated. For the bass control we measured 12dB boost and 10dB cut at 100Hz and for the treble control, 11dB boost and 13dB cut at 10KHz relative to 1KHz — figures which indicate that the tone control facilities are conventional and adequate.

With the tone controls set for flat response and the "contour" of the volume control cancelled, the frequency response of the amplifier, at a level of 1 watt, was flat from the lower limit of our generator (18Hz) to 30KHz (-3dB point) being -6dB at 45 KHz. The power bandwidth was much the same. The square wave response, as could be expected, was good; a 5KHz square wave exhibiting a slight trace of overshoot on the leading edge and one well-damped cycle of ringing. Stability with capacitative loads was also good.

In terms of power output, load and distortion, the specifications are anything but precise. One can only assume that the rating of "50 watts IHF" refers to the total power available from both channels on program material, into 8 ohm loads, and that the harmonic distortion under these conditions does not exceed 1 p.c.

It would have taken more time than was available to resolve fully the interrelation of power output, load and distortion but, as a general guide to performance, we measured the steady-tone power output at the onset of clipping at 1KHz. With either channel driven seperately, power output into an 8-ohm load was 15 watts; with both channels driven simultaneously, power output was 10 plus 10 watts. Into 16-ohm loads, the power was 8 watts per channel, with little difference, in this case, whether the channels were driven simultaneously or not.

Signal-to-noise ratio is specified by the manufacturers at -90dB relative to full output — no mean figure to which to lay claim. In practice, we found that, with the volume and bass controls full on and with open-circuit phono inputs, the hum level was quite noticeable. However, the instruction manual suggests reversing the power cord if the hum is audible and, when we tried this, the hum was reduced considerably. Under actual listening conditions, with the volume control at about 12 o'clock, there was no noise audible, even close up to the speakers.

No circuit diagram is provided with the manual but a circuit from another source indicated that the power amplifier was of conventional solid-state design, using driver transformers to the output stage. It is notable, however, that Mosfets are used in the FM tuner.

To summarise, the Harman Kardon Nocturne is a well made amplifier of conventional and accessible design, and is capable of stereo reproduction of high standard.

Inquiries should be directed to Recorded Music Salon who can supply full details on prices and availability. (L.D.S.) ■

M A T V

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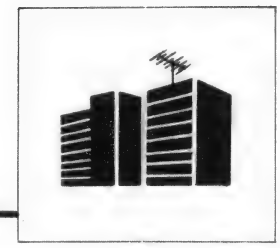

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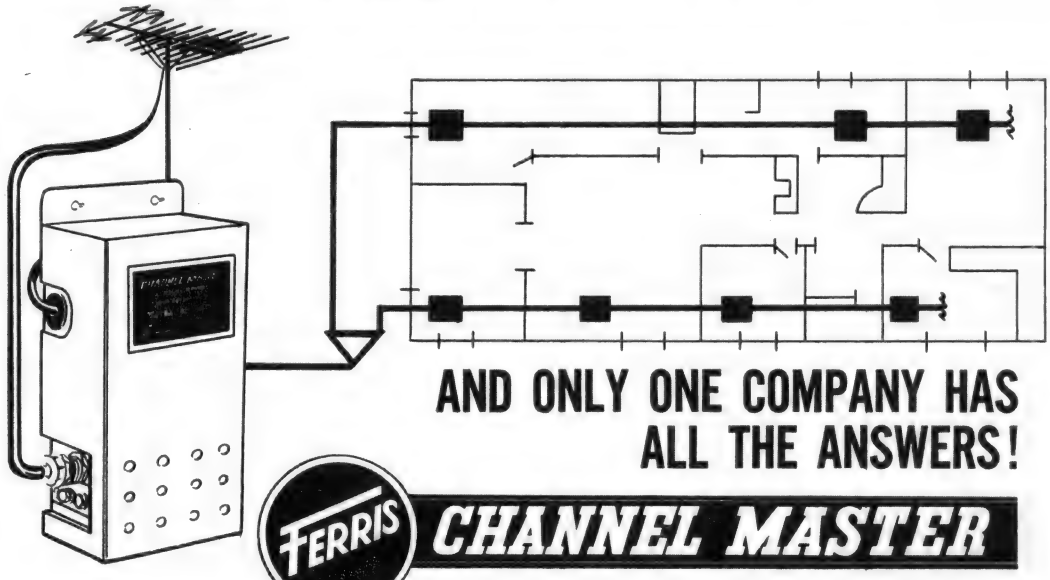

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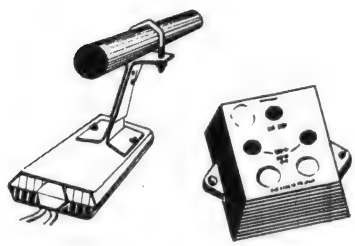

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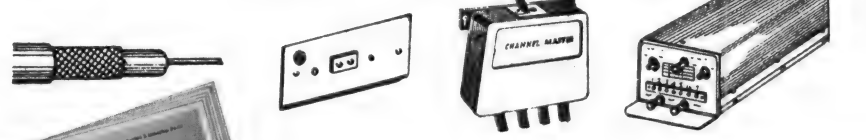

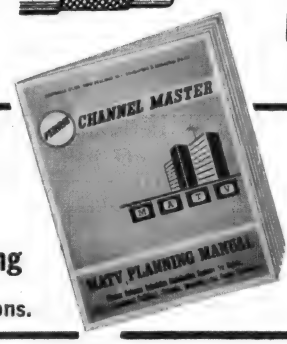

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TRADE RELEASES IN BRIEF

JACOBY, MITCHELL AND COMPANY PTY. LTD. have advised that the arrangements which Grundig, of Germany, have made with A.E.I., of U.K., reported recently in an Australian trade paper, will in no way affect the existing arrangements under which Jacoby, Mitchell are the sole stockists/agents for Grundig closed-circuit television camera equipment and associated equipment for the whole of Australia.

All sales, installation and servicing of Grundig closed-circuit television equipment supplied in Australia will remain exclusively with Jacoby, Mitchell. However, A.E.I., of U.K., now has facilities for including the Grundig "Fernauge" equipment as a component part of any system or equipment installation tendered for by A.E.I. All inquiries for Grundig closed-circuit television equipment should be referred to the Jacoby, Mitchell head office at 469-475 Kent Street, Sydney; or branch offices at 15 Abbotsford Street, Melbourne, Victoria; 652 South Road, Glandore, Adelaide, S.A.; 56 Edward Street, Brisbane, Qld.; Mr C. F. Liddelow, 252 William Street, Perth, W.A.; Mr K. W. McCulloch, 109 York Street, Launceston, Tasmania.

EMERSON AND CUMING, INC., of U.S.A., send details of their Ecco Reflectors. An Ecco Reflector is a spherical passive device which reflects and returns to its source a radar signal almost as efficiently as a flat metal plate of the same diameter. Being spherical, it is capable of reflecting simultaneously radar signals from any direction over a broad-viewing angle. This is not possible with a flat metal plate, the face of which must be pointed towards the source of the radar signal.

Ecco Reflectors are widely used to enhance the radar reflectivity of drones, targets and decoys. They are based on the Luneberg Lens, and when used in an array not only increases the radar cross-section but also produce scintillation patterns which are useful for simulating natural targets and for identification purposes as passive radar beacons.

A technical note is available which discusses Ecco reflector array design and applications in detail. (Emerson and Cuming are represented in Australia by Wm. J. McLelland and Co. Pty. Ltd., The Crescent, Kingsgrove, N.S.W.)

Varian Associates, of U.S.A., has announced two new series of K-band reflex klystrons, EM-1188 and EM-1138, operating in the 18 to 26.5GHz band. These are designed primarily for use as pump tubes in parametric amplifiers, and tune over a 1000MHz range. The EM-1188 develops at least 400mW and EM-1138 a minimum of 50mW. Both offer a wide selection of power levels and have an exceptionally long operating life. Frequency and power stability of these rugged klystrons is excellent, the makers say. (Further details from Varian Pty. Ltd., 38 Oxley Street, Crow's Nest, N.S.W. 2065).

NEW VTVM FROM UNIVERSITY GRAHAM

The stylish vacuum tube voltmeter illustrated has been recently released by University Graham Instruments Pty. Ltd. Of Japanese manufacture, the instrument comes complete with a DC and Ohms measuring probe. EHT and RF probes and carrying case are available as optional extras.

The new voltmeter, Model MVA-6, is housed in a sturdy but attractive metal case, finished in grey crackle enamel with a "satin" etched front panel and a chrome carrying handle. Also fitted are black instrument-knobs and four rubber feet, with the intention that the instrument should normally stand upright.

The internal construction features a printed wiring board and standard wafer switches with tied wiring forms. The large meter scale measures 4in x 4½in with easy-to read graduations, the full scale deflection sensitivity being 195uA. Also incorporated in the meter circuit are protective diodes contained in a single encapsulation. These provide the meter with a high degree of protection, over and above that normally afforded by the valve circuitry.

Accuracy of the meter is stated as ± 3 per cent for DC ranges and ± 5 per cent for the AC ranges. Spot checks of the ranges against a meter of known accuracy showed that the instrument was in fact well within the claimed tolerances. The voltmeter has two valves, a 12AU7 twin triode and a 6AL5 twin diode for the AC rectifying circuit.

The MVA-6 measures P-P and RMS alternating voltages from 30Hz up to 500KHz direct and with the RF probe (type RF-22) up to 60MHz, according to the manufacturers rating. On test, we found that, used directly, the voltmeter was 1dB down at 50KHz on the AC voltage ranges. However, by way of compensation response using the RF probe proved to be flat from 30KHz (1dB down at 10KHz) to well above 60MHz.

The DC and RMS voltage scales are: 1.5, 5, 15, 50, 150, 500, 1500. It will be noticed that the lowest range is 1.5V, a distinct advantage for use with transistor circuitry, ascending in steps of approximately 10dB, to the 1500V range. This is multiplied twenty times when using the EHT probe (type HV-20), thus giving a top voltage range of 30KV. While the EHT probe performed satisfactorily, its internal construction seemed rather more makeshift than the more expensive probes which have commonly been offered to date.

Resistance up to 1000Mohms may be measured on the forward reading ohms ranges and, with a centre scale resistance of 9.25 ohms, resistance as low as 1.0 ohm can be measured accurately. The front panel controls are: a function switch (which includes a power on-off switch) a range selector switch; ohms adjustment; meter zero adjustment. When the function switch is set to "off", a short circuit across the meter damps pointer movement during transportation.

Price of the Model MVA-6, including DC probe, is quoted as $42 plus tax. Accessories available are an RF probe (type RF-22) $6 plus tax, an EHT probe (type HV-20) $8 plus tax and a leather carrying case priced at $6 plus tax. University Graham also offers full after-sales service for the instrument. Any further enquiries should be directed to University Graham Instruments Pty. Ltd., of 106 Belmore Road, Riverwood, N.S.W. (A.J.L.)

GEMCO DIVISION of Pye Industries Ltd. has introduced to the Australian market a range of aluminium take-off busbars and feeder busbars, said to incorporate a revolutionary and time-saving system. Called "One Bolt Connection," this new design is the result of two years of concentrated design and development work. It cuts erection time and costs by up to 60 per cent over conventional busbar systems.

The connection is made by using a single bolt and a special spring-cup washer which gives a constant positive pressure of 1,000lb sq. in. over the conductor surfaces. This minimises temperature rise, allows high conductivity and provides sufficient flexibility to compensate for expansion and cold flow.

The assembly method is simple and straightforward. The slotted ends of one length of busbar are pushed around the captive bolt on the other length, and spacers are inserted. Before the bolt is tightened, the connecting lengths can be positioned anywhere within a 200 degree arc on the horizontal plane, thus avoiding the necessity for elbows and T pieces. Branch busbars

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All silicon transistor record player for those who want quality reproduction at a **very reasonable** price Space saving integrated amplifier-record changer (Garrard 3000) gives total of 10 watts RMS at less than 1 per cent distortion. Frequency response (amplifiers) within 2 dB 30c/s to 35 kc/s.
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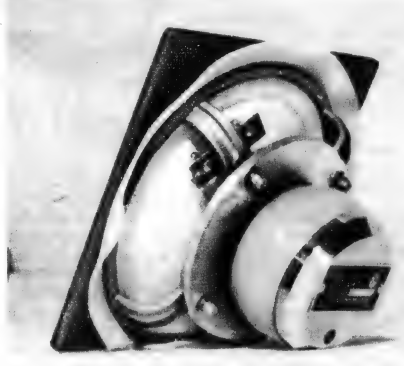
For those who want top quality we have the Klinger KC.24 with the same amplifier but including Garrard SP25 player and the new ADC 220 magnetic cartridge.
Send for prices and leaflets.



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ELECTRONICS INDUSTRIES has advised that there has been a re-organisation of the board of its subsidiary company, Eclipse Radio Pty. Ltd. This entails the retirement of three of the seven directors of the parent company from the Eclipse Radio board and the inclusion on the board of the retail managers of Eclipse Radio in each of the six States. The retiring directors are Mr J. P. Salvado, Mr L. A. Machin and Mr L. M. Stuart. The new board members are Mr N. T. Dawson (Tasmania), Mr R. H. Buchanan (Victoria), Mr A. W. Harkess (W.A.), Mr K. G. Alsop (S.A.), Mr J. Alvos (N.S.W.), and Mr B. A. Lucas (Queensland).

RACAL ELECTRONICS PTY LTD., has introduced a new pre-set timer for industry. Called Type 805BR, it is designed primarily for use in an industrial environment to facilitate digital indication of speed, speed ratio and period measurements to at least 1MHz. The digital timebase if fully variable between 1 microsecond and 99.999 seconds, allowing the latched 5-digit in-line display to indicate measurements in any normal engineering parameter, such as meters/minute, gallons/hour or revolutions per minute. The timebase stability is one part per million per month. All circuits are mounted on plug-in printed wiring cards, and silicon transistors are used throughout for reliable operation in the temperature range minus 10 to plus 50 degrees C. Input sensitivity is 100mV and input impedance is 100Kohms. (Racal Electronics Pty. Ltd., 75-77 Chandos Street, Crow's Nest, N.S.W.)

RACAL ELECTRONICS PTY. LTD. advises that its new TA905 100W single side-band transistorised radio transceiver will make it possible for outback areas to have telephone facilities approaching those provided in the more populous areas. When used with signalling and terminating equipment, the TRA905 is capable of providing clear telephone quality communications in areas where it is not practical to instal land lines for normal telephone systems. One of the outstanding features of the equipment's operation is that while it may be operated from either mains supply or batteries, its frequency stability is such that stable operation over periods of several months is possible without the need for adiustments of any kind. It requires practically no attention under normal conditions of operation. (Racal Electronics Ptv. Ltd., 75-77 Chandos Street, Crow's Nest, N.S.W.)

PLESSEY AUTOMATION has developed very compact data transmission systems for use in commercial establishments where there is a low volume of information to be communicated. The equipment uses integrated circuits, and is small enough for table top operation. It can be operated in either the simplex or duplex mode, and transmission (18 characters per second) can be over public telephone networks or over private wire circuits.

The system has full automatic error correction, using the Plessey patented tape back-space technique, thus referring to the source of data and reducing electronic storage to a minimum. The equipment can be switched to handle any five, six or seven channel code, or an eight channel code containing a parity bit, and provides a clean tape output. (Plessey Automation, 13-17 Botany Street, Redfern, N.S.W. 2016.)

DIGITAL EQUIPMENT AUSTRALIA PTY. LTD. has introduced a new low-cost memory disc which significantly expands the storage capacity of its PDP-8 and PG-8/S computers. This DF32 DEC disc memory module has a single magnetic disc for storage and electrical interface. It has a capacity of 32,768 thirteen-bit words (12 bits plus parity) and the capability of expansion to 131,072 words with the addition of up to three expander discs of 32,768 words each. The company claims this is the lowest-priced disc on the market for providing a bulk storage capability for its small general-purpose computers, and represents a significant price-performance breakthrough.

The DF32 is a fixed disc with one head per track. The transfer rate is 66 microseconds per 12-bit word. Average access time is 16.67 milliseconds. The disk and interface control is designed to satisfy a requirement for an economical means of medium bulk storage for both random and sequential access with Digital Equipment's PDP-8 and PDP-8/S computers. (Digital Equipment Australia Pty. Ltd., 89 Berry Street, North Sydney, N.S.W.)

EIMAC DIVISION of Varian has introduced in the U.S.A. a new line of miniature planar triodes for advanced airborne and space applications. These new 8755, 8756 and 8757 triodes are miniature versions of the company's 8533, 7815 and 7698 valves. They are of rugged ceramic-metal construction, and feature large contact areas for improved electrical paths. They use arc-resistant cathodes and provide good high-frequency efficiency in the S-band. Improved packaging methods provide for better design of tubes into RF cavities. Cooling is by forced air or heat sink. The new valves may be used as amplifiers or oscillators in either pulsed or CW modes. (Eimac are represented in Australia by Varian Pty. Ltd., 38 Oxley Street, Crow's Nest, N.S.W.)

STANDARD TELEPHONES AND CABLES PTY. LTD. is the 1967 recipient of the Hoover Exort Award. This award was established in 1963 to stimulate export activity and encourage the development of Australia's overseas markets. The winning by S.T.C. of the 1967 award climaxes five years of spectacular increases in the volume and value of its overseas sales—from a modest $515,000 in 1962 to around $3,000,000 last financial year.

PLESSEY PACIFIC PTY. LTD. has acquired the Melbourne-based company Vinten Communications Products Pty. Ltd., manufacturers of radiotelephone equipment. Announcing this, Plessey Pacific chairman, Sir Giles Chippindall, said the move would consolidate Plessey's involvement in the mobile radiotelephone field, in which it had been active for many years through its subsidiary, Communications Systems of Australia Pty. Ltd. Sir Giles said the two founder partners of Vinten Communication Products, Mr Donald V. Hope and Mr Neville B. Lovett, would remain as active members of the company.

PLESSEY AUTOMATION-ELECTRONICS has available a portable transistorised peak-reading distortion meter, measuring only 8 x 4½ x 3in. Designated PDM10, the meter is designed to measure peak distortion on direct current telegraph circuits. It is battery powered, and operates on the shortest pulse principle, whereby only those elements shorter than unit length are measured. The shortest pulse—representing peak distortion—is indicated on a meter display which may be reset automatically at either of the two time constants, or retained for a period with manual reset. When used as the shorter reset time, the instrument is suitable for observing distortion variation while aligning terminal or VF (voice frequency) equipment.

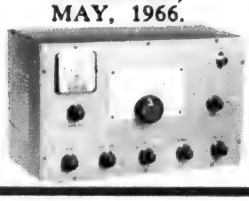
A secondary meter scale is provided for line voltage and line current measurements for shunt and series monitoring respectively. Provision is also made for checking the internal batteries, which provide a minimum life of 75 hours' continuous operation at 20 degrees C. A selector switch allows monitoring of "Mark" elements only, "Space" elements only or all elements to assist in identifying the type of distortion present. The PDM 10 may be used with signals of any unit code and with start-stop or synchronous systems. Five fixed speeds may be provided within the range 45 to 200 bauds. (Plessey Automation Electronics. 13-17 Botany Street, Redfern.)

K I T S

Public Address Units — Geiger Counters — Metal Locators — Decade Boxes — Mixers — Battery Chargers — Oscillators — Bridges — Parts Supplied for Projects in Electronics (Aust.), Wireless World, Practical Wireless, Electronics World, Electronics Illustrated, Practical Electronics, etc.

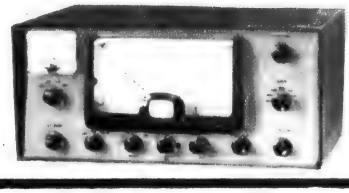
K I T S

3-BAND DOUBLE CHANGE RECEIVER, MAY, 1966.



4-CHANNEL AUDIO-MIXER, FEB., 1966-1967.

5-BAND DSB TX, NOV. 1965.



INSTRUMENTS.
1 5in Wide Range C.R.O.
2 * 3in F/C C.R.O.
3 3in C.R.O. (1966).
4 C.R.O. Elecronic Sw.
5 C.R.O. Wide Band Preamp.
6 Standard Audio C.R.O.
7 Project Multimeter 20K/V.
8 Meterless Voltmeter.
9 Millivoltmeter (A.C.).
10 Trans Millivoltmeter (A.C.).
11 Noise-Distortion-Millivoltmeter.
12 VTVM.
13 1966 — VTVM.
14 * 1960 Audio OSC.
15 * 1962 Audio GEN.
16 6-Band OSC. RF and AF.
17 Trans Service OSC.
18 STD. Audio OSC.
19 Trans Audio OSC.
20 D/R A/F Meter.
21 Simple Signal Injector.
22 Trans Signal Tracer.
23 Trans Wave Meter.
24 G.D.O. Adaptor.
25 Wide Range G.D.O.
26 1966 Basic Test OSC.
27 Square Wave GEN.
28 XTAL Locked STD.
29 Electronic Tuning STD.
30 Pattern GEN.
31 Trans Pattern GEN.
32 5.5 and 36 MHZ Sweep GEN.
33 Sweep and Marked GEN.
34 Silicon Diode Sweep GEN.
35 Silicon Diode Noise GEN.
36 * R.C. Bridge.
37 1966 R.C. Bridge.
38 Geiger Counter.
39 Direct Reading Impedance Meter.
40 Simple Proximity Relay Alarm.
41 Electronic Anemometer.
42 * Light Beam Relay Alarm.
43 Electronic Stethoscope.
44 * Valve and Transistor Tester.
45 Resonance Meter.
46 Moisture Alarm.
47 Trans Alarm.
48 Flasher Unit.
49 Photo Timer.
50 Pipe and Wiring Locater.
51 S.W.R. Indicator.
52 Electronic Pistol Range.

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53 Universal Battery Charger.
54 Battery Charger—1 AMP.

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55 Trans REG. 9v P/Sup.
56 Trans Fully Protected.
57 1966 H.T. REG. P/Sup.

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58 Model Train Control Unit.
59 Vari-Watt Power Controller.
60 Vari-Tach Motor Speed Control.
51 2KW—Automatic Light Dimmer.
52 4KW—Automatic Light Dimmer.

TACHOMETER.
63 6 or 12 Volt Kit.
64 * 6 or 12 Volt, Mullard.
65 6 or 12 Volt Tach and Dwell Angle.
66 Tach and Dwell Angle Unit for Service Stations.

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67 6 or 12 Volt (RO-FO).
68 6 or 12 Volt Ign. (TX type).
69 Automotive V/Meter.

DC-DC CONVERTER.
70 DC-DC 60 W.
71 DC-DC 40 W. 12V IN.
72 DC-DC 70 W. 12V IN.
73 DC-DC 100 W. 12V IN.
74 DC-DC 140 W. 24V IN.
75 DC-DC 225 W. 24V IN.

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76 HI-FI 3.
77 Mullard 3-3.
78 Mullard 5-10.
79 Mullard 2-20.
80 * Wireless World 20-20 20w. (Trans.).

STEREO UNITS.
81 Mullard 3-3.
82 Mullard 5-5 (Trans.).
83 Mullard 10-10 (Trans.).
84 Mullard 10-10.
85 * Wireless World 20-20.
86 Playmaster Unit 3.
87 Playamster Unit 9.
88 Playmaster Twin 10.
89 Playmaster 101.
90 Playmaster 105 (Trans.).
91 Playmaster 113 (Trans.).
91A Playmaster 115 (Trans.).

P.A. and GUITAR AMPIFIERS.
92 10 Watt Stand. or Guitar.
93 25 Watt Standard.
94 35 Watt Standard.
95 100 Watt P.A.
96 25 Watt Guitar.
97 35 Watt Guitar.
98 50 Watt Guitar.
99 20 Watt Golden Series.
100 Playmaster 102 Guitar.
101 Playmaster 103 Guitar.

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102 Playmaster No. 9.
103 Playmaster No. 10.
104. Playmaster No. 104.
105 Playmaster No. 111.
106. Playmaster No. 112.
107 Philips M'Watt Unit.
108 Mullard 2V. Unit.
109 Mullard 3V. Unit.
110 Mullard Preamp and W/B Tuner.
111 Transistor Mono Preamp.
112 Transistor Stereo Preamp.
113 Sil/Trans. Mono Preamp.
114 F.E.T./Trans. Mono Preamp.
115 F.E.T./Trans. Stereo and Preamp.
116 DYN MIC. PREAMP.
117 4-CHAN. Audio Mixer.

TUNERS.
118 P'master Unit Style.
119 P'master 114.
120 Mullard Wide Band Tuner and Preamp.
121 Philips M'watt Hi-Quality Tuner.

RECEIVERS.
122 Fremodyne 4—1967.
123 Communications RX.
124 Deltahet RX.
125 All Wave Transistor 2.
126 All Wave Transistor 3.
127 3-Band D/Change S/Het.
128 * 1967 Interceptor 5.
129 ALT. T'sistor Car Radio.
130 Transporta 7 (RF).
131 Little General 1961.
132 3 Band 8 Transistor.
133 3-Band 3- (AC).
134 Interstate 5 (AC).
135 All Wave T'sistor 3.
(* Kit Release Date — August, 1967.)

TRANSMITTERS.
136 144 MHZ Linear Final (50w).
137 144 MHZ TX (20w).
138 144 MHZ TX (75w).
139 144 MHZ TX (18w).
140 144 MHZ S.S.B. TX.
141 3-Band AM. TX.
142 Basic 3-Band TX.
143 5-Band DBS TX.
144 S.S.B. T.

V.F.O. UNITS.
145 Remote V.F.O.
146 769 HF and VHF.
147 All Transistor.

MODULATORS.
148 Modulator 50w.
149 MOD-PA and P/Supply Unit.

CONVERTERS—RECEIVER.
150 Short Wave Unit.
151 2-Band S/Wave Unit.
152 3-Band S/Wave Unit.
153 Basic S/Wave Unit.

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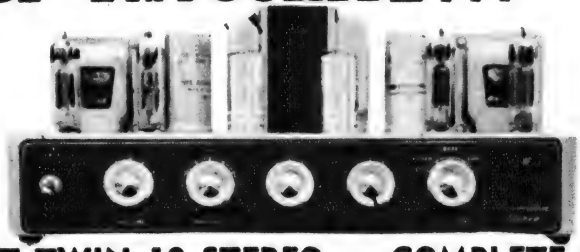

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TECHNICAL BOOKS AND PUBLICATIONS

Telemetry Circuits

UNDERSTANDING TELEMETRY CIRCUITS, by John D. Lenk. Published by Howard W. Sams and Co., Inc., Indianapolis, New York, 1966. Stiff paper covers, 8¼in x 5¼in., 160 pages, illustrated throughout with diagrams, circuits and graphs. Price in Australia $4.25.

By way of a general definition, author John Lenk introduces telemetry as "any system that permits measurement over a long distance." He explains further, that the term covers the total system: the original transducer, the equipment that modifies its output into a suitable electrical signal, the means of relaying that signal over a carrier or cable link and, finally, the means of returning the signal to a form which can be visually read, or recorded for further reference.

To the average "radio" engineer, technician or enthusiast, there would be nothing especially new about such an explanation. He may be at a loss, however, to say much more about this specialised field, involved as it is with the relaying of data ranging from routine industrial processes to the monitoring of space vehicles. Even the terms Triple FM, PAM, PDM and PCM may be unfamiliar.

The aim of this book is to correct this situation and to provide an introduction to telemetry for those who have never had occasion to give it much thought. It is written at technician level and is substantially free of mathematics, but this reviewer's impression is that it could be read to advantage by anyone needing the information which it contains.

Chapter 1 is introductory: "A Look At Telemetry Equipment." Chapter 2 covers "Signal-Conditioning Circuits"—the circuits that transform transducer output into electrical signal of the desired form. Succeeding chapters deal with the various basic transmission systems: FM/FM, PAM (pulse amplitude modulation). PDM and PCM. The last three chapters have to do with typical telemetry signal format, magnetic recording for telemetry systems and the binary counting system, which is so fundamental to modern data processing. The book concludes with a glossary and index.

In all, this reviewer's reaction was to rate it as a very useful text and, to judge by sample reading, well written. Our copy came direct from the publishers but local supplies should be available shortly. (W.N.W.)

Marketing Design

ELECTRONIC SYSTEMS for Convenience, Safety and Enjoyment, by E. A. Altshuler. Published by W. Foulsham and Co. Ltd., Slough, Bucks, England, 1965. Hard covers, 255 pp., 8¼in x 5¼in. Many illustrations. Price in Australia $5.10.

Few will deny that electronics is today's fastest expanding industry. Among the major reasons for this rapid expansion are the various space and satellite programs and the many military applications of electronics. The author of this book maintains, however, that the industry should not be so dependent on Government projects and should be seeking more actively the consumer and business markets. In short, this is a book about marketing, a subject which too many people in the electronics industry seem to neglect, according to the author.

He emphasises that people don't buy components and engineered systems! They buy comfort, entertainment, convenience, versatility, status, pleasure and usefulness—a fact that is not always given proper weight by electronics marketing people. The book is very readable and enjoyable and covers the marketing of electronics in many fields: entertainment, communications, computers and controls, medicine, offices, homes, schools, etc.

While written primarily for the American situation, it is a book which should be very interesting to people in all countries involved with the marketing of electronic products. Our copy came from Grenville Publishing Co., 154 Clarence Street, Sydney. Copies should be available from all technical bookstores. (L.D.S.)

Transistorised TV

SERVICING TRANSISTOR TV, by Robert G. Middleton. Published by W. Foulsham and Co. Ltd., Slough, Bucks, England, 1966. Hard covers, 8¼in x 5¼in. 223 pp., many photographs and diagrams. Price in Australia $5.10.

This book is one of the first available in this country on the servicing of transistorised television receivers, previous books on transistor TV having been devoted mainly to theory and design. In fact, there are very few all-transistor designs being marketed at present in Australia, most manufacturers being more concerned with hybrid types. Even so, the circuitry dealt with in the book is destined to appear in Australian sets, allowing for the differences in transmission standards.

The book is well written and the material is set out in an orderly fashion. The opening chapter is a general introduction to the subject of transistor television servicing. In succeeding chapters, the author proceeds through the receiver section by section, starting with the tuner, and finishing with the power supply.

We did notice one or two misleading picture captions, an example being on page 7. The caption states that Barkhausen lines occur only in hybrid receivers when, in actual fact, they can occur in any receiver using a valve-powered horizontal output stage; the matter is clarified, however, on page 187.

Despite such minor reservations, the book can be recommended to anyone wishing to learn about transistor television servicing. Our copy came from the Grenville Publishing Co., 154 Clarence Street, Sydney. Copies are available from all technical bookstores. (L.D.S.)

Device Fundamentals

TRANSISTORS AND VACUUM-TUBE FUNDAMENTALS, by Gilbert L. Rainey. Published by Holt, Rinehart and Winston, of New York, Chicago, San Francisco, Toronto and London. Soft covers, 8½ x 11, 233 pp. Price in Australia, $5.20.

The author has written a series of five books in a "Basic Industrial Electronics Series," intended primarily for technical colleges and other comparable tuitional situations. This is the second of the series.

It is essentially a laboratory guide book, setting out a series of experiments in logical order and aimed at presenting the more practical aspects of vacuum tube and semiconductor fundamentals. While intended primarily for students with access to basic "practical work" facilities, it would be of similar value to private students able to arrange use of basic radio components and test instruments at about "serviceman" level. Even without such access, the book could be studied to advantage on the basis of the procedures set out.

The author has assumed a modest background of the theory involved but this would be strengthened and ordered automatically as the various experiments were performed or studied.

In all, some 32 experiments are set out. Seventeen of these are based on semiconductor devices, although some of the more advanced experiments deal with the general principles of circuit configurations, rather than just the operation of the device.

For each experiment the objectives are set out. Thus Experiment 20—The Testing Of Transistors—has for its objectives: (1) To learn to test transistors with common laboratory instruments. (2) To learn the meaning of Iceo. (3) To construct a simple transistor tester. The objectives are pursued by experiments and explanations, and interspersed questions test the reader for comprehension.

Within the limits of its intention the book would be a valuable asset in the planning of a program of helpful laboratory measurements and experiments. Others in the series are: Basic Electricity, Electronic Circuits, Electronic Control Circuits and Communications Electronics.

Our copy came from the Australasian distributors, Rigby Ltd., 22 James Place, Adelaide, S.A. (A.J.L.)

Service Techniques

TEN MINUTE TEST TECHNIQUES for Electronics Servicing, by Elmer Carlson. Published by Tab Books, Thurmont, Maryland, U.S.A., 1967. Hard covers, 176 pp., 8½ in x 5½in, many diagrams, circuits, etc.

As the title indicates, this book is aimed at the service technician—presumably either as a refresher for the man already in business or as a guide-book for the up-and-coming serviceman. The author's basic contention is that most faults are due to fairly elementary failures and can be located by simple test procedures—provided the serviceman adopts a systematic approach. The concept is: "Think first and follow one of the suggested 10-minute test techniques."

The book begins with a chapter on "Fundamentals of Trouble-shooting," under which the author discusses series and parallel R.C. networks, in-circuit capacitor testing, multiple component networks and locating defective stages.

Thereafter follow chapters on Power Supplies—Filters, Bleeders and Regulators—Special Purpose Power Supply Tests—Basic Amplifier Tests—Amplifier Tests With A Scope—Basic Oscillator Tests—Special Amplifiers And Transmitters. In each of these chapters the author talks about typical circuits, situations, components, test equipment and test techniques. He points out in the preface that the material does not follow any closely planned sequence, over and above the major chapter divisions, and he also stresses that much of it will not be particularly new to the average reader. His invitation is to browse through the book and read the sections that catch the eye.

All this sounds very promising for those with an interest along these lines but spot reading of the text does not inspire all the confidence that it might. In Chapter 2 a discussion on testing series heater strings can scarcely be classed as lucid. On page 131 the reader is told that 1 volt A.C. is equal to 2.88 volts peak to peak, instead of 2.828, with no mention of the significance of waveform. On page 130 are C.R.O. diagrams which might mean something to a reader prepared to take

time off to puzzle them out. On page 133 are charge and discharge diagrams that would appear to bear very little resemblance to the true shapes to be seen on a C.R.O. face.

In short, while the author has started out with a good idea and a good stock of typical service techniques, his efforts at setting them out would have benefited enormously from a more critical analysis of his material by a technically capable sub-editor. Since this is a first edition and a first printing, there should be opportunity to make revisions, should it transpire that this reviewer's reservations are justified. Our copy came direct from the publishers. (W.N.W.)

Properties of Crystals

CRYSTALS, P. Kratochvil. Originally published by S.N.T.L., Prague. Published in English in the "Physics Paperbacks" series by Iliffe Books Ltd., London. Stiff paper cover, 112 pages, 8in x 5in.

With the continuing proliferation of solid-state techniques, specialists in electronics are finding it increasingly necessary to have some understanding of particle behaviour in the so-called "solids." Like other books in this series which we have reviewed, this one should provide an excellent introduction to the whole subject of crystal structures, either for the student who wishes to study it in close detail or for the specialist in other subjects who wishes to expand his background by suitably selected, if rather demanding, reading.

About half of the book is devoted to an examination of the structure of atoms and nuclei, inter-atomic forces and the arrangement of atoms in solids. This leads on to a description of space lattices, the structure of actual crystals and the kind of structural imperfections which can typically occur.

Chapter 3, involving some 35 pages, discusses the origin of crystals, the growth of crystals from a melt, zone refining techniques and the preparation of crystals, including germanium and piezoelectric for electronic applications, metal monocrystals and "whiskers."

A final chapter covers the electrical, mechanical, optical and magnetic properties of crystals. Altogether a most useful book for the student or for the serious reader, and one that should be relatively inexpensive. Our copy came direct from the publishers but copies should be obtainable through local technical booksellers. (W.N.W.)

A Study of Currents

EDDY CURRENT, by J. Lammeraner and M. Stafl. Originally published by S.N.T.L., Prague. Published in English by Iliffe Books Ltd., London. Hard covers, 233 pages, 8in x 5¼in.

Engineers and technicians connected with electronics are well aware of the existence of eddy currents and of typical situations in which eddy currents are variously a liability or an asset. But this knowledge is largely superficial and based on more or less incidental reference in textbooks and articles.

In this work, the authors have collected between two covers a systematic study of the subject for the sake of advanced students and/or engineers who may have cause to specialise along these lines. They have assumed that the reader will have a background, at engineering level, of electrical theory and mathematics and that the subject can be pursued from that basis. Their plan is to discuss individual aspects of the subject in general terms, then to examine them more particularly by working out typical practical examples. If follows that the book will be of little value to readers unable to take notice of the mathematical expressions, which occupy far and away the bulk of the text.

The chapter headings are as follows:
Physical principles of eddy currents.
Skin effect.

Electromagnetic waves.
Utilisation of eddy currents.
Effect of eddy currents on the waveform of an electromagnetic surge in a transmission line.
Conduction of current in a cylinder in a magnetic field.
Unsymmetric distribution of current and magnetic flux.
Conductors of special cross-sections in slots.
Introduction to methods of approximate calculation of eddy currents.
Method of step-by-step approximation (the iterative method).
Graphical methods of eddy current determination.
Using the skin depth.
Current density distribution along the circumference of a conductor.
Conductive body in a non-homogeneous alternating magnetic field.

As will be evident from the above, this is a book on a very specialised subject, but, in so far as there are very few other comparable books available, it should be of special interest to particular individuals. Our copy came direct from the publishers but copies should be obtainable through major technical booksellers. (W.N.W.)

Machine Intelligence

MACHINE INTELLIGENCE I, edited by N. L. Collins and D. Michie. Published by Oliver and Boyd Ltd., Edinburgh, 1967. Hard covers, 6¼in x 10in, 278 pp., many diagrams. Price in Australia $9.80.

Intended to be the first volume in a series to be released annually, this book reports the proceedings of the first Annual Machine Intelligence Workshop organised by Dr Donald Michie and his Experimental Programming Unit in the University of Edinburgh in September, 1965. The contributions are by workers from a number of different centres of research and cover a wide range of projects being pursued in the field of "machine intelligence." Together they give an impressive picture of the state of this somewhat esoteric art at the time of the meeting.

The contributions are classified into a number of major sections, these being labelled: Abstract Foundations — Theorem Proving—Machine Learning and Heuristic Programming — Cognitive Processes: Methods and Models —Pattern Recognition —Problem-Oriented Languages. From two to five papers are presented in each section.

I think it true to say that the level of discussion in the majority of the papers is such that they will be almost unintelligible to all but those actively involved in theoretical programming and computer research. And it is primarily to such people that the book is directed, rather than to the interested layman or even the normal computer user. To those for whom it will be intelligible, it will no doubt make highly interesting and valuable reading.

Our copy came from the Australian distributors for Oliver and Boyd, who are Rigby Limited, of 22 James Place, Adelaide. We understand that copies will be available from the larger bookstores by the time this review is published. (J.R.)

Magnetism

MAGNETISM IN SOLIDS, by D. H. Martin, Ph.D. Published by Iliffe Books Ltd., London, 1967. Hard covers, 6in x 10in, 452 pp., 149 illustrations. Price in U.K. 120/ net.

The aim of the author in writing this book, as he informs the reader in his preface, has been to give a broad account of the subject as currently conceived—one which takes the discussion of major topics to the point of current investigation. It is intended primarily for new graduates in physics and electronics who wish to specialise in research into magnetism and who therefore require a comprehensive introduction to the present state of knowledge in this field; however, it is anticipated that it will also be of interest to those who graduated before the modern concepts of magnetism in solids had been fully developed, and as an introduction to basic problems in magnetism for experienced researchers who have specialised in other fields.

Probably the best way to give a concise summary of the content material and its order of presentation is to quote the chapter headings: 1.—The Characteristic Properties of Magnetically Ordered Solids. 2.—The Origins of Magnetism in Atoms and Ions. 3.—Diamagnetism and Paramagnetism in Solids. 4.—The Molecular Field Models of Ordered Magnetic Solids. 5.—Exchange Interactions between Two Electrons. 6.—Exchange Interactions in Solids. 7.—The Excited States and the Statistical Mechanics of Ordered Magnetic Solids.

The book ends with a list of some 300 reference works and a source bibliography.

Dr Martin is Reader in Experimental Physics at Queen Mary College in the University of London, a Fellow of the Institute of Physics and a noted authority in the field which forms the topic of this book. As one would expect from this, the book is particularly well presented and reveals not only a thorough knowledge of the subject but a clear grasp of the requirements of effective communication. The writing is crisp and concise and the progression of thought systematic. Those for whom it was written should thus find it an extremely valuable addition to their reference library.

Our copy came direct from the publisher, who gave no information regarding Australian price and availability. However, the publication date in the U.K. was in January, 1967, suggesting that copies will be already available in local bookstores by the time this review is published. (J.R.)

Lasers at Work

LASERS, by K. Patek. Published by Iliffe Books Ltd., London, 1967. Hard covers, 6in x 8¼in, 288 pp., many illustrations. Price in U.K. 45/ net.

A specialist-level monograph on the operation and application of lasers, written for the scientist or engineer working either in the field of laser research or in the many fields in which lasers are finding application. It is a revised and enlarged English translation of a book published in 1964 by S.N.T.L., publishers of technical literature in Prague. The English translation has been edited by Dr V. W. Rampton.

After an introduction covering the basic physics of light emission and the conditions necessary for laser action, the author describes the three basic types of laser—the original solid-state laser which uses a dielectric crystal or glass, the later-developed gas laser, and finally the injection laser based on the semi-conductor junction diode. After a brief survey of other types he then gives lengthy discussion of applications of lasers in physics, optics, communications and ranging, materials testing and treatment, biology and medicine. The book concludes with a very comprehensive bibliography (some 30 pp.) and an index.

The text of the book is both lucid and commendably concise, and although slightly rigid—possibly as a consequence of translation—it should be found eminently readable and informative by those for whom it has been written. Some of the diagrams are perhaps a little smaller than would be desirable for convenient reference, but this is only a minor point.

For engineers and physicists concerned with lasers and their applications, this is a book which should be of considerable value.

The copy reviewed came direct to our office from the publisher in England, and no information was supplied regarding Australian price and availability. However, as the U.K. publication date was in February, copies will no doubt be available here very shortly if not by the date this review is read. (J.R.)

Elements of Computers

COMPUTERS SELF - TAUGHT THROUGH EXPERIMENTS, by Jack Brayton. Published by W. Foulsham and Co., Ltd., Slough, England. (Foulsham-Sams Technical Series, No. CEB-1) Hard covers, 5½in x 8¼in, 192 pp., many diagrams and photographs. Price in Australia $5.10.

In his preface to this book the author notes that his aim in writing it was to demonstrate to the reader, via side-by-side theory and simple experiments, that digital computers are basically composed of large numbers of relatively simple and easily understood functional elements. I think he has realised this aim, although from a theoretical point of view the treatment is probably described most accurately as "rather sketchy." The theory which is presented is in general quite sound, while the series of experiments described are quite well planned and presented. This should make the book very suitable as a "first introduction" to practical digital concepts for the home experimenter and senior High school pupil, and possibly also as source of tuitional ideas for the science teacher.

The chapter headings give a fairly accurate idea of the content material and its order of presentation: 1—The Binary Number System; 2—Basic Computer Functions; 3—Pulse-shaping Circuits; 4—Transister Facts; 5—Pulse-generating Circuits; 6—Experiments with Logic Circuits; 7—Transistor Logic Circuits; 8—Logic Adders; 9—Logic Substrators; 10—Matrix Circuits

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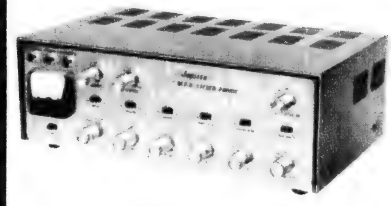
Containing 60 assorted components, inc. 5 carb. pots. (at least one w/sw), 2 trimmer pots, 10 paper cond., 5 low watt elec. cond., 5 high volt. elec. cond., 12 solder lugs, 2 yd. shield wire, 5 yd. P.V.C. hook-up wire, 2 transistor trans., 2 knobs, 2 yd. solder, 25 res. (1 watt, ½ watt and wire wound).

$3.30 each *plus postage 20c.*

JUPITER STEREO AMPLIFIER



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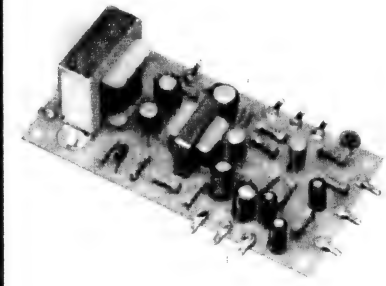

4 transistor—1 watt output. High Impedance Input—100,000 ohms. Low Impedance Input—1,000 ohms Output—4, 8, or 16 ohms. Power Source—6 Volts. Gain—70 DB. Size of board. 4½in x 2in approx. Weight: 6 ozs. Supplied with circuit and wiring instructions.

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Approved by Electronics Aust. for use in speaker cabinets. Made from White Dacron Polyester Fibre. Will not crack or break when folded.

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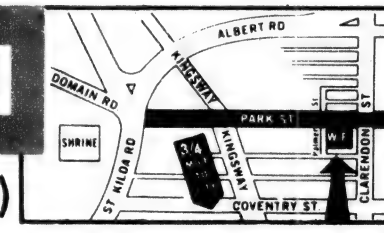

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tions in critical aerospace and military equipment.

TA-2848, TA2858, TA2859 developmental type high-frequency silicon NPN transistors featuring forward AGC characteristics and low feedback capacitance for TV tuner and IF amplifier applications.

Further details are available from Amalgamated Wireless Valve Company Pty. Ltd., 348 Victoria Road, Rydalmere, N.S.W.

STANDARDS ASSOCIATION OF AUSTRALIA has issued two Australian standard specifications laying down general performance characteristics and other requirements for sound-level meters. These are ASX Z37, covering general-purpose meters, and AS Z38, covering precision meters. The new standards are virtually identical with recommended standards of the International Electrotechnical Commission. For the purpose of the standards, general-purpose meters are designated Type 1 and precision meters as Type 2. Meters of Type 2 are required in laboratories or for taking accurate measurements where stable high-fidelity and high-quality apparatus is necessary.

Prices of the two standards are: AS Z37, 80c; AS Z38, $1. Copies are obtainable from the various offices of the Association in capital cities and Newcastle.

PHILIPS MINIWATT has published two new data books. The first is an up-to-date listing of all Miniwatt semi-conductors showing, in tabulated form, type number, case type, description, absolute maximum ratings, characteristics and special parameters. Additional sections are entitled "Terms and Definitions" and "Base Outlines."

The second data book deals with valves and picture tubes for TV receivers, audio applications and mains-operated radio receivers. This has the usual operational data, with type numbers and descriptions, and a complete tabulation of the pin connections in each case.

Inquiries relating to these publications should be addressed to Miniwatt Division of Philips Electrical Pty. Ltd., 20 Herbert Street, Artarmon, N.S.W.

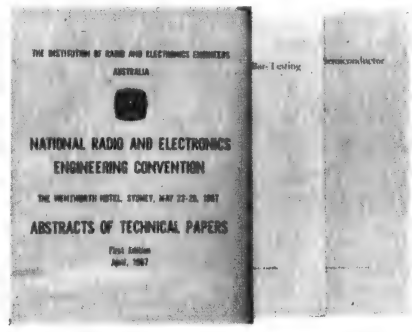
RESEARCH NOTES, published by Varian Aerograph, of California, U.S.A., discuss the use of a helium detector for analysis of fixed gases. The publication includes a general discussion of the apparatus, and various descriptions of applications including "Lung Diffusing Capacity in Intact Guinea Pigs." "Gas Chromatography in Diet Research" and "Impurities in Hydrogen." Copies may be obtained from Varian Pty. Ltd., 38 Oxley Street, Crow's Nest, N.S.W.

STANDARDS ASSOCIATION OF AUSTRALIA is seeking comment on a draft standard for lead acid batteries as used in cars. The draft is issued for public review as Doc. 1180, and is a proposed revision of Australian Standard D2-1958. The revision is intended to ensure satisfactory performance of car batteries under present day conditions of service. The major changes proposed relate to performance testing and the inclusion of a current acceptance test; also, on the basis of available meteorological data, a significant reduction of the temperature at which the cold-performance test is conducted. Other matters relate to overcharge life test at elevated temperature, and requirements for busbars and "through the partition" intercell connections.

Copies of Doc.1180 may be obtained free from the headquarters of the association, 157 Gloucester St., Sydney, and from branch offices in all capital cities and Newcastle.

VARIAN ASSOCIATES, 38 Oxley Street, Crow's Nest, N.S.W., has published a 20-page brochure describing the M-66 mass spectrometer. The brochure discusses the instrument's sweep system, power supplies and electronics, vacuum system and its operation, the analyser, and other features and specifications. In addition, there is a 4-page section on applications with sample spectra.

I.R.E.E. Publications



THE INSTITUTION OF RADIO AND ELECTRONICS ENGINEERS AUSTRALIA has published, in book form, abstracts of technical papers prepared for the 1967 I.R.E.E. Convention. A limited number of these is available to delegates who attended the convention. The 230-page soft-bound book contains a substantial abstract of about 1,000 words with key diagrams for every paper presented at the convention. Requests for copies should be accompanied by a remittance of $3.50.

Reprints of the paper by Mr H. S. Blanks entitled **"A Comparative Study Glossary of Semi-conductor Devices"** originally published in the March, 1967, issue of "I.R.E.E. Proceedings" are also available, price 0.50c a copy. This contains a summarised description and comparative assessment of these devices and their technologies.

Another reprint available is the paper by Mr A. N. Thiele entitled **"Methods of Waveform-Pulse and Bar-Testing"** published in the December, 1966, issue of "I.R.E.E. Proceedings," price 0.75c a copy.

Orders accompanied by remittance should be sent to I.R.E.E. Australia, Box 3120, G.P.O., Sydney, N.S.W. 2001.

★ ★ ★

PLANAR, June/July, 1967, is the first issue of a new company publication by Fairchild Australia Pty. Ltd. It contains company news, product information and short articles describing equipment using Fairchild components. We understand "Planar" is a controlled-circulation magazine supplied free and post free. Inquiries should be sent on company letterhead to Fairchild Australia Pty. Ltd., P.O. Box 151, Croydon, Victoria.

NATIONAL BUREAU OF STANDARDS in the U.S.A. advises publication of the following: Trace Characteristics — Chemical and Physical, edited by W. Wayne Meinke and Bourdon F. Scribner. N.B.S. Monograph 100, April 28, 1967, 580pp, price $US4.50. This brings together state-of-the-art summaries in most of the areas pertinent today for trace characterisation and offers a glimpse of problems to be faced in the future. Also, summaries of contributed papers and discussions bring attention to current research in characterisation and round out the treatment of each subject.

Copies may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Remittances must be in U.S. exchange and should include an additional one-fourth of the publication price to cover mailing costs.

NEW DEVELOPMENTS, Issue BO32. July, 1967, the new products bulletin of Jacoby, Mitchell and Co. Pty. Ltd., has descriptions of the following items; C.E.C. Direct Writing Recording Oscillograph type 1-127; Colvern Wirewound Trimmer Potentiometers type TPI; E & M Wave Guide Attenuator model M15SA; Siliconix Field-effect Transistors types 2N4084, 2N4085, U200, U201 and U202; Advance UHF Signal Generator model SG69; Sanders Educational Microwave Equipment; and a range of Sweep Generators from Telonic Instruments. Inquiries to the company at 469-475 Kent Street, Sydney, N.S.W. ■

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Frequency Response : 100~10,000 c/s±8 dB
†Sensitivity : −52 dB±3 dB,
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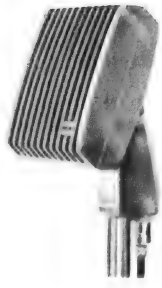
Cable : 4 ϕmm, 3 m
Weight : 1¼ lbs (525 g)

DF-1DE

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~10,000 c/s±8 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 385.5 mm high
21 mm diameter, microphone
128 mm diameter, stand
Cable : 4 ϕmm, 1.5 m
Weight : 1⅝ lbs (840 g) with cable



*DF-14B

SPECIFICATIONS
Impedance : 50 kΩ Variable
Frequency Response : 100~10,000 c/s±8 dB
†Sensitivity : −48 dB±3 dB,
Dimensions : 136×75×47 mm
Cable : 6 ϕmm, 4 m
Weight : 2 lbs (900 g)

*DF-22B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s±7 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 32.5 mm diameter, 220 mm long
Cable : 6 ϕmm, 4 m
Weight : 1¼ lbs (575 g)

DF-1/*DF-1B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s±8 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 21 mm diameter, 82.7 mm long
Cable : 3 ϕmm, 1.5 m
Weight : 3.9 oz (110 g) with cable

DF-3

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s±8 dB
†Sensitivity : −56 dB±3 dB,
Dimensions : 33.5 mm diameter, 133 mm long
Cable : 4 ϕmm, 1.5 m
Weight : 9.0 oz (255 g) with cable

DF-12/*DF-12B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 80~12,000 c/s±8 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 23 mm diameter, 158 mm long
Cable : 3 ϕmm, 1.5 m
Weight : 6.3 oz (180 g) with cable

*DF-2B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s±10 dB
†Sensitivity : −56 dB±3 dB,
Dimensions : 75×53×30 mm
Cable : 3 ϕmm, 1.5 m
Weight : 4.8 oz (136 g) with cable

*DF-51B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~8,000 c/s±7 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 98×58×36 mm
Cable : 6 ϕmm, 1.6 m, Coiled
Weight : 7.3 oz (207 g) with cable

* with switch : † at 1,000 c/s, 0 dB=1 V/μ bar

AMATEUR BAND NEWS AND NOTES

The Amateur Radio Service — An Independent Survey

The Stanford Research Institute (U.S.A.) has recently issued a report which examines all aspects of the Amateur Radio Service in relation to its international mandate, and to regulations which govern the service in various countries of the world.

By Pierce Healy, VK2APQ*

To provide a ready source of information that would enable delegates attending international conferences and government administrators, to have a sound understanding of the relative value of the amateur radio service, the American Radio Relay League requested the Stanford Research Institute to conduct an independent study that would summarise and assess the past, present and projected contributions of the amateur radio service to the national welfare.

The 110 page report is set out in three parts. Part 1 deals with:

(a) Historical trends in the amateur radio service.

(b) Characteristics of radio amateurs and the amateur radio service.

Part 2 covers:

(a) The technological impact of the amateur radio service.

(b) The economic impact of the amateur radio service.

(c) The sociological impact of the amateur radio service.

Part 3:

The amateur radio service as a national resource. The title of the report is:

Amateur radio: An international resource for technological, economic and sociological development.

While some of the facts recorded are common knowledge to most amateurs, the report contains a wealth of information for amateurs themselves and should be of more than passing interest to those who know little of the background of amateur radio.

With that in mind, in this and future issues of these notes, details will be given of sections of the report to enable:

(a) Amateurs to have available a ready source of factual information.

(b) Non-amateurs to appreciate the real asset the amateur radio service is to the community.

The amateur radio service achieved formal international recognition at the International Telecommunications Union conference in Washington, D.C., in 1927. Today the service operates under a general mandate that has remained essentially unchanged since that time:

"A service of self-training, intercommunication and technical investigations carried on by amateurs, that is, by duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest."

Because the Amateur Radio service in the United States was found to be typical (except in size) of amateur services in most other countries, data were primarily collected on that service. On the basis of these data, the project team drew parallels with the similar experience of the other technologically advanced countries that have supported the amateur radio service and, finally, developed the implications of these experiences for new and developing countries.

Data and information developed in this report were derived primarily from three sources: A literature search, inteviews, and a survey questionnaire.

The summary and conclusions as stated in the report are: "The information developed in this study leads to the conclusion that the amateur radio service is a national and international resource whose curtailment would constitute a serious loss to the technological, economic, and sociological welfare of all nations. Its status as a non-profit, voluntary public service organisation suits it uniquely to its primary purpose, to serve the public interests in the countries in which it operates.

"But of equal importance is the effect of the service as a stimulus to economic growth. In addition to the economic stimulus resulting from the manufacture and sales of amateur equipment, the service has indirectly influenced economic development, as equipment and techniques developed for amateurs have been adapted for commercial and governmental uses.

"Radio amateurs have also played a significant role in the development of the state of the radio art and, even with the advanced stage of current technology, they are continuing to make major contributions both to basic radio theory and to practical applications.

"Importantly, the cost of the services rendered by radio amateurs are borne by the amateurs themselves, without any commitment of public funds. This fact, in combination with the professional quality of the technical expertise of radio amateurs and the impetus to all phases of national development that results from their activities, makes the amateur service an especially desirable adjunct to the communications plants of the new and developing countries.

"The following is a listing of specific contributions made by the Amateur Radio Service. Although the contributions are closely interrelated, we have attempted to group them according to the category of their primary influence.

Technological:

- Constitutes a source of new techniques and new technology in communications and electronics and stimulates the development of these in other fields.
- Provides a broad base for experimental test of theoretical predictions and for participation in large scale investigation in a variety of scientific areas.
- Provides a medium for self-training in, and improvement of, communications and electronic skills.
- Provides a medium for rapid and widespread exchange of communications, electronics, and other special knowledge and techniques.

Economic:

- Advances the economy through the manufacture and sales of amateur equipment.
- Advances the economy indirectly through extension of amateur radio and related equipment into the professional, consumer, and governmental markets.
- Provides a source of trained manpower and impetus for an expanding communications and electronics manufacturing capacity.
- Appears to play a significant role in raising the general level of technological knowledge.

Sociological:

The contributions made by the amateur service in this category are of two types: Communications services and indirect contributions to general welfare. Some of the contributions in this category are unique to the amateur service; many have come to be regarded as vital.

Vital communications services:

- Provides emergency communications in support of disaster relief organisations (e.g., fire, police, other public service agencies).
- Disseminates news when other communications systems have temporarily failed.
- Broadcasts warning of potential natural or other disaster.
- Provides special communications support for medical crises (e.g., searches for rare blood types) and other medical functions (e.g., the Eye Bank Network).
- Disseminates weather news.

Non-vital Communications Services:

- Provides short, medium, and long distance point-to-point communications of a specialised nature, such as for scientific expeditions and for servicemen and other emissaries of a country abroad.
- Assists in the development of international understanding and goodwill through person-to-person contacts.
- Projects a nation's image abroad more credibly than do international broadcasts.
- Provides communication support for special community and other functions (e.g., parades, local and regional fairs and Boy Scout Jamborees).

Indirect Contributions to the General Welfare:

- Provides incentive for scientific, engineering, and technical career.
- Provides impetus for a broader and more technically sophisticated education system.
- Provides a reservoir of trained communications and electronics specialists.
- Where telecommunications are minimal, helps to bring people of isolated regions of a country together under a common national bond.
- By self-policing, lightens the administrative burden of a nation's spectrum managers.

"The amateur service is exceptionally conservative of spectrum space when the ratio of services rendered per kilocycle of spectrum allocations is considered.

***News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W.**

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"Any other radio service, performing the same functions to the same degree, would require not only a larger commitment of public funds, but also significantly more spectrum space than is now allocated to radio amateurs."

Appendix "C" of the Stanford report is a chronology of amateur contributions to technology:—

June, 1896: Marconi first demonstrated the practicality of radio communication. Although later engaged in radio communication as a professional, he nevertheless regarded himself as an amateur.

July, 1899: American Electrician published the first information on construction of radio equipment in an article directed to amateur experiments.

1906: DeFrost patented his "audion" triode, using it as a non-regenerative detector. Although he was an amateur experimenter at the time, DeFrost was employed immediately afterward to develop a triode amplifier for telephone toll lines. His first amplifiers tended to oscillate and it was his work to overcome the oscillation that enabled him officially to defeat Armstrong's claim to have been the first to understand regeneration. Engineering opinion today generally credits Armstrong with having acted first.

1908: Amateurs began to use adjustable tuning and indirect (i.e., inductive) coupling to the antenna, instead of depending solely on antenna periodicity. The patent situation that existed then prevented commercial operators from doing the same.

1912: Armstrong, a 22-year-old college student, discovered the principles of regenerative feedback. Unable to obtain enough funds for a patent he had his notebooks notarised. He first announced his discoveries to the Radio Club of America, an amateur organisation, in 1915 and remained an amateur until U.S. entry into World War I. His regenerative detector was the first practical electronic amplifier of any kind.

1915: Apgar, an amateur, developed a mechanical linkage between headphones and "Dictograph" and used it to record against a Telefunken transmitter on Long Island that was transmitting information on allied shipping to Germany. This was probably one of the first electronic sound recorders.

December 19, 1919: Armstrong first described the superheterodyne circuit, which he developed in France as director of a Signal Corps laboratory, to the Radio Club of America. His description was published in "QST" (February, 1920) about a year before it appeared in Proceedings of the IRE. All but the simplest receivers in every service today are superheterodynes.

June 1, 1920: In co-operation with the National Bureau of Standards, amateurs began a two-year series of fading tests that led to the understanding of ionosphere propagation.

September 24, 1920: Kruse, an amateur, in a paper before the Radio Club of America, first suggested that fading might result from interference between what are now called "ground waves" and "sky waves." This is one of the earliest recorded instances of amateur speculation about ionsphere propagation, which culminated with the theory developed by Reinartz (see entry for April, 1925).

November 2, 1920: Conrad began transmitting music on his amateur station in Pittsburgh. Westinghouse, his employer, took over his station as a commercial venture and secured for it the call sign, KDKA.

January, 1922: Phelps, an amateur, succeeded in causing a 100-watt transmitting tube to operate on 35 metres (8,570KHz). In a subsequent article in "QST" (March, 1922) he urged amateurs to move into shorter wavelengths to alleviate congestion.

August, 1922: Armstrong announced the development of a superregenerative detector circuit. Although it is seldom used for shortwave reception, it proved valuable a decade later in the exploration of very-high and ultra-high frequencies.

December 8, 1922: Godley, a U.S. amateur, using a superheterodyne receiver, first heard U.S. amateurs across the Atlantic.

PROJECT OSCAR — LATEST NEWS

The July issue of the OSCAR news bulletin from the Project OSCAR organisation California contained details that appeared in last month's issue of these notes relating to the Australis OSCAR satellite.

Also given was a comment to the effect that tests and evaluations of the EURO-OSCAR satellite package is still proceeding. However, some delays are being experienced by reason of the time required to exchange notes with DJ4ZC, the builder.

Comments on launch and orbital operations information were:

"We regularly receive queries concerning advance information about the scheduling of a launch and requesting notice when a launch has occurred. Suffice to say that it is our policy to disseminate any information that we have in the fastest possible way. It is not possible to specify any preferred method of obtaining and disseminating such information, because the problem here consists essentially of those conditions imposed upon us through our relationship with the launch agency.

"Moreover each launching is a different case. For OSCAR 1 we had observers at the launch site and were able to follow the progress rather closely. For OSCAR 3 we learned of its launching after the satellite was on its way. OSCAR 4 was a widely published launch; anyone listening on 20-metre sideband could follow the countdown from the OSCAR network.

"The best source of launch information will be W6EE, whose operating schedules will be published in the Newsletter QST, and over the air when the launch time becomes imminent. There will also be a special newsletter distributed in advance if this turns out to be possible. Often we can announce a launch window — these times should be followed carefully with information channels kept open during these periods. During the launch periods, rumours travel fast and furiously. Your best bet is to keep tabs on W6EE or W1AW for up-to-date, accurate information.

OSCAR Bulletin Schedules. One way to keep current on OSCAR activities is to monitor the bulletins transmitted by W6ASH on Thursday evenings (Pacific Day-light Saving Time) which is Friday morning (Greenwich Mean Time). These bulletins are transmitted by CW at approximately 18 to 20 words per minute; watch 14.030MHz at 0200 GMT (Friday) and 7.015MHz at 0500 GMT (Friday).

The Australis OSCAR satellite and three members of the team who delivered the package to Project OSCAR Inc. in the United States. Left to right: Owen Mace, Richard Tonkin, Paul Dunn. (Picture by courtesy of "The Age.")

AMATEUR TELEVISION

Congratulations go to the Bangalore Amateur Radio Club of India for their interest in promoting amateur television in that country.

G. V. Sulu, VU2GV, the club secretary and editor of their magazine 'SIRAN' has produced a special amateur television issue. The 80-page magazine contains articles on amateur television from all over the world, including an illustrated article by Andrew Pierson, VK5ZBP/T, of the South Australian ATV group.

High praise is given by AN Venkatraman, VU6VU, to the initiative of Mait Lane VK5AO/T, Andrew Pierson, VK5ZBP/T and John Twinning in his review of a tape letter sent by them, giving details of their experiences and experiments with Amateur Television.

The magazine probably contains a greater cross-section of world-wide amateur television articles than has been previously published under one cover. Certainly an achievement for a club in an area where there is no television service, the only service in the country being at New Delhi.

VK-ZL — OCEANIA DX CONTEST

The Wireless Institute of Australia and the New Zealand Association of Radio Transmitters, the national amateur radio associations in Australia and New Zealand, invite world-wide participation in the 1967 VK—ZL—Oceania DX Contest.

OBJECTS:

For the "world" to contact Australian, New Zealand and Oceania stations and vice versa. **Note:** Australian and New Zealand stations, irrespective of their locations, do not contact each other for contest purposes.

DATES:

Phone: 24 hours from 1000 hours GMT on Saturday, October 7, 1967, to 1000 hours GMT on Sunday, October 8, 1967.
C.W: 24 hours from 1000 hours GMT Saturday, October 14, 1967, to 1000 hours GMT on Sunday, October 15, 1967.

RULES

1. There shall be three main sections to the contest
   a. Transmitting — phone.
   b. Transmitting — CW.
   c. Receiving — phone and CW combined.
2. The contest is open to all licensed amateur transmitting stations in any part of the world. No prior entry need be made. Mobile marine or other non-land based stations are not permitted to enter.
3. All amateur frequency bands may be used, but no cross-band operation is permitted.
4. Phone will be used during the first weekend and CW during the second weekend. Stations entering both sections must submit separate logs for each model.
5. Only one contact per band is permitted with any one station for scoring purposes.
6. Only one licensed amateur is permitted to operate any one station under the owner's call sign. Should two or more operate any particular station, each will be considered a competitor, and must submit a separate log under his own call sign. (This is not applicable to overseas competitors.)
7. Entrants must operate within the terms of their licences.
8. **CIPHERS:**
   Before points can be claimed for a contact, serial numbers must be exchanged and acknowledged. The serial number of five or six figures will be made up of the "RS" (telephony) or "RST" (telegraphy) report plus three figures which may begin with any number between 001 and 100 for the first contact and which will increase in value by one for each successive contact.
   Example: If the number chosen for the first contact is 021, then the second must be followed by 022, followed by 023, 024 etc. After reaching 999, start again from 001.
9. **SCORING:**
   a. For Oceania stations other than VK/ZL: 2 points for each contact on a specific band with VK/ZL stations; 1 point for each contact on a specific band with the rest of the world.
   b. For the rest of the world other than VK/ZL stations: 2 points to reach contact on a specific band with VK/ZL stations; 1 point for each contact on a specific band with Oceania stations other than VK/ZL.
   c. For VK/ZL stations: 5 points for each contact on a specific band and in addition for each new country worked on that band, bonus points on the following scale will be added:
   1st CONTACT—50 points. 2nd contact—40 points. 3rd contact—30 points. 4th contact—20 points, 5th contact—10 points.
   For this purpose the ARRL countries list will be used, with the exception that each call area of WK, JA, and UA will count as "countries" for scoring purposes as indicated above.
10. **LOGS:**

(i) **Overseas Stations:**

   a. Logs to show in this order—date, time in GMT, call sign of station contacted, band, serial number sent, serial number received, points. Underline each new VK/ZL call area contacted. A separate log for each band must be submitted.
   b. Summary sheet to show the call sign, name and address (block letters), details of station, and for each band, QSO points for that band. VK/ZL call areas worked on that band.
   "All-band" score will be the total QSO points multiplied by sum of VK/ZL call areas on all bands, while "single-band" scores will be that band QSO points multiplied by VK/ZL call areas worked on that band.

(ii) VK/ZL Stations:

   a. Logs must show in this order — date, time in GMT, call sign of station worked, band, serial number sent, serial number received, contact points, bonus points. Use separate log for each band.
   b. Summary to show — name and address in block letters, call sign, score for each band by adding contact point and bonus points for that band, and "all-band" score by adding the band scores together, details of the station and power, declaration that all the rules and regulations have been observed.

11. The right is reserved to disqualify any entrant who, during the contest has not strictly observed regulations or who has consistently departed from the accepted code of operating ethics.
12. The ruling of the Federal Contest manager of the W.I.A. will be final.
13. **AWARDS:**
    VK/ZL Stations: The Wireless Institute of Australia will award certificates as follows:
    1. To the top scorer on each band irrespective of single band or multi-band operation and irrespective of call areas, i.e. a maximum of five awards may be made for VK and ZL.
    2. To the top scorer in each VK and ZL call district, i.e. a maximum of 14 awards, 10 VK and 4 ZL awards may be made.
    To be eligible for awards in either of the abovementioned categories, an operator must obtain at least 1,000 points, or there must be at least three competing entries in the category.
    Overseas Stations: Certificates will be awarded to each country (call areas in WK, JA and UA) on the following basis:
    1. Top scorer using "all bands" provided that at least three entries are received from the "country" or the contestant has scored 500 points or more.
    2. Other certificates may be awarded, to be determined by conditions and activity.
    N.B. There are separate awards for Phone and CW.
14. **ENTRIES:**
    All entries should be posted to: Federal Contest Manager, W.I.A., Box N1002, G.P.O. Perth, Western Australia. VK/ZL entries to be received by December 16, 1967.
    Overseas entries to be received by January 20, 1968.

RECEIVING SECTION

1. The rules are the same as for transmitting section, but the receiving section is open to all members of any short-wave listeners society in the world. No transmitting staion is permited to enter this section.
2. The contest times and logging of stations: on each band per weekend are as for that transmitting section, except that the same station may be logged twice on any one band—once for phone and once for CW.
3. To count for points, logs will take the same form as for transmitting, as follows: date, time in GMT, call sign of station heard, call sign of station he is working, RS(T) of the station heard, serial number sent by the station heard, band, points claimed. Scoring is on the same basis as for transmitting section and the summary should be similarly set out with addition of the S.W.L. society in which membership is held.
4. Overseas station may log only VK/ZL stations but, VK receiving stations may log overseas stations and ZL stations, while ZL receiving stations may log overstations and VK stations.
5. Certificates will be awarded to the top scorer in each overseas scoring area and in each VK/ZL call areas, provided that at least three entries are received from that area or that the contestant has scored 500 poins or more.

International Amateur Radio Club

The 1967 convention of the International Amateur Radio Club will be held in Geneva, Switzerland, on September 22, 23 and 24. The proceedings will commence at 19.00 hours on Friday 22 with an official welcome at the I.T.U. building, followed by an informal I.A.R.C. reception. The official Convention Banquet and Dance will be held on Saturday evening.

During the weekend there will be sessions set aside for technical discussions, when a number of well known amateurs will be guest speakers. Sightseeing excursions have also been arranged for Sunday, September 24.

Registration applications for the convention should be made to: The International Amateur Radio Club, P.O. Box 6, CH-1211 Geneva 20, Switzerland.

Registration for accommodation should be sent to: American Express Co. Inc., Group Travel Dept., Geneva, Telegrams to Amexco-Geneve.

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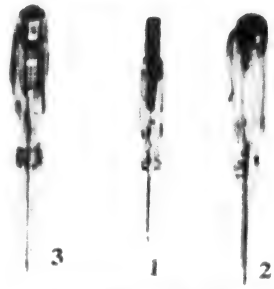

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Actual Size

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30,000 Ohms per Volt D.C.

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Clear Scale, rugged moulded case.

SPECIFICATIONS

DC Voltages: 0-0.3-1.2-3-12-30-120-300-600-1,200 V at 30,000 Ohms per volt.

AC Voltages: 0-3-12-30-120-300-600-1,200 V at 13,000 Ohms per volt.

DC Current: 0-.06-6-60-600 mA, 0-12 A.

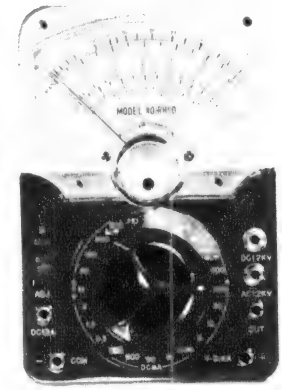
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).

Decibels: minus 20 to plus 57 dB (0 dB equals 1 mW, 600 ohms).

Audio Out: Capacitor in series with AC volt ranges.

Short Test: Internal buzzer.

Accessory: 1 pr. heavy test leads.



Price $31

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Batteries: 1 (1.5V), 1 (15V).
Size: 3 5-16" x 6 5-16" x 2¼"
Weight: 1.4lb approx.

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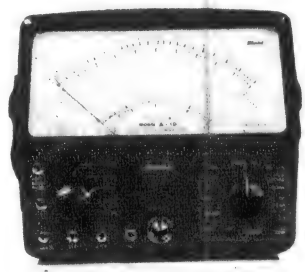
With Test Leads and Injector Probe



30,000 o.p.v.

SPECIFICATIONS: 6in x 2½in scale.

DC Voltage: 0-0.5, 2.5, 10, 50, 250, 500, 1,000V at 30,000 o.p.v. 5,000 and 25,000 V at 10,000 o.p.v.

AC Voltage: 0-2.5, 10, 50, 250, 500, 1,000 V at 10,000 o.p.v.

Volume Level in Decibels.

DC Current: 0-50 uA, 1, 50, 250 mA, 0-1 and 10 amps.

AC Current: 0-1, and 10 amps.

Resistance: 0-10K, 100K, 1M, 100 Megohms. Signal Injector Output Jack. Zener Diode Overload Protection.

Price $60.00

LIMITED STOCK ONLY

Model RH-10

RANGES:

DC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.

AC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.

DC Current: 0-500uA 0-500 mA.

Resistance: 0-10K-1Meg: 60 ohms, 6K ohms at centre scale.

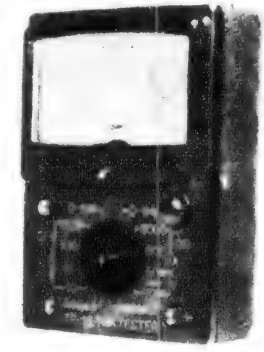
Capacitance: 250uuF to 1uF, in two ranges.

Decibels:—20 to plus 36db, two ranges.

Output; 0-1,000 V in four ranges.

Size: 5in x 3½in x 1½in.

Weight: 13oz approx.



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Compact—2in x 1¼in.
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Model RH-5

- High sensitivity-20,000 Ohms/V DC, 10,000 Ohms/V AC.
- 3in Meter.
- Handy pocketable size.

SPECIFICATIONS

DC Voltages: 0-10-50-250-500-1000 V (20,000 Ohms/V).

AC Voltages: 0-10-15-250-500-1000 V (10,000 Ohms/V).

DC Current: 0-50uA, 0-5-50-500mA.

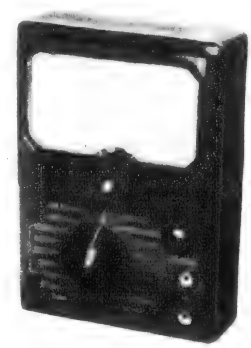
Resistance: 0-10K, 0-100K, 0-1Meg, 0-10 Meg. (62 Ohms, 620 Ohms, 6.2K, 62K at centre scale).

Capacitance: 0.0001uF-0.005uF, 0.05uF-1uF.

Decibels: minus 20db to plus 36db in 2 ranges.

Dimensions: (3½in x 5¼in x 1¾in).

Weight: 15oz approx.



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WIRELESS INSTITUTE ACTIVITIES

Members of the Federal Council of the Wireless Institute of Australia recommend that all amateurs aquaint themselves with facts quoted in the Stanford Research Institute report on the Amateur Radio Service, so that they will be in a position to state facts and figures, if and when it becomes necessary to discuss frequency allocations with those who are in a position to support the amateur service in Australia.

NEW SOUTH WALES

The appointment of a full time administrative secretary in the New South Wales division marks a new era in the history of the division. The appointment will allow many changes to be implemented and the services to members, particularly country members, to be improved.

The office of the N.S.W. division, Wireless Institute Centre, 14 Atchison Street, Crow's Nest (near St. Leonards Railway Station), is now open from 9.30 a.m. to 3.30 p.m. each Tuesday, Wednesday and Thursday.

For telephone inquiries ring Mrs M. Long at the Wireless Institute Centre, 43-5795.

Council is desirous of establishing a regular communications net among zone officers of the division. Cyril Henderson, VK2CH, is in charge of this project and can be contacted on the air, each Monday evening, following the Hunter branch broadcast from VK2AWX, on 3595KHz.

A.O.C.P. CLASSES

The high percentage of passes gained by those who have attended the New South Wales Division's Amateur Operators Certificate of Proficiency classes reflects the ability of the class supervisor, Cec. Bardwell, VK2IR, to impart the necessary knowledge to students. There are a few vacancies in the last-term classes for 1967, for those who may wish to do a refresher course in preparation for the P.M.G. Department's January examination. Classes are held each Tuesday and Thursday evening.

Call or write to the Class Supervisor, Wireless Institute Centre, 14 Atchison Street, Crow's Nest, 2065.

A correspondence course is also available for those who are unable to attend the lecture classes. Full details may be obtained from the same source.

To assist those wishing to improve their proficiency in the reception of Morse Code, a nightly session is conducted on the air by the N.S.W. Division on 3550KHz, in the 80 metre band from the official station VK2AWI, commencing at 7.30 p.m.

Also as an adjunct to the sessions on the air, a recorded Morse tape service is available. Full details of this service may be obtained by writing to: Ern Hodgkins, VK2EH, Mangrove Road, Narara, 2251, N.S.W.

HUNTER BRANCH

The annual Hunter Branch Field Day will be held on Sunday, October 15, at Bolton Point Park of Lake Macquarie. A full and interesting program has been arranged for both amateurs and Youth Radio Scheme members and, in addition, there will be some special arrangements for the family.

This year, lunch will be served to those registering at the field day, the registration fee being $1 single or $2 for a family ticket. Arrangements are also in hand to have liquid refreshments for all.

Field events will include, four 144MHz and two 7MHz hidden transmitter hunts and a 7MHz scramble. It is expected that there will be displays of commercial equipment and some bargains from the radio equipment store.

A new contest activity came into being on Monday, July 24, when Hunter Branch members were invited to take part in a VHF scramble following the Monday night broadcast. It is planned that there will be a number of these contests during the year and the place-getters in each event will be awarded points, to be credited for a prize to be awarded at the Annual General Meeting in 1968.

The lecturer at the July meeting of the Branch was Gordon Sutherland, VK2ZSG, who gave an excellent talk on modifications to the "Command Series" of receivers. The full range of these popular disposals receivers was discussed and Gordon outlined some novel alterations and additions to make these sets perform as their designers had never intended. The modifications included various forms of limiters, "S" meters, output stages, and double conversion. To illustrate his remarks the lecturer supplied each member of the large audience with an eight-page booklet describing, in detailed circuits, the modifications discussed.

In addition to the lecture, an excellent colour film from the Japanese National Railways was presented, featuring the super express Hikari, which has just carried its hundred millionth passenger since it began operation in 1964.

Monday night broadcasts from the Hunter Branch station VK2AWX, are made weekly on frequencies of 3595KHz and 144.4MHz. The news session commences at 7.00 p.m. and callbacks are taken on both frequencies. At present, an experiment is being conducted into the relative merits of AM and SSB for the high frequency band broadcast and reports on reception are welcomed by the operator responsible for the transmission.

Reports on reception should be addressed either to the operator in person or to VK2AWX, 15 Marine View, Newcastle, 2300. New South Wales.

The next meeting of the Branch will be held in Room 6, Clegg Building, Newcastle Technical College, Tighe's Hill, on Friday, October 6, commencing at 8.00 p.m.

The president of the Hunter Branch issues a cordial invitation to all interested in amateur radio, whether Institute members or not.

CENTRAL COAST BRANCH

A program of wide interest was the feature of the July meeting of the Central Coast Branch of the New South Wales Division.

Ern Hodgkins, VK2EH, who recently made a tour of the Snowy Mountains Scheme, gave a very interesting commentary on the latest developments in the area as he showed a collection of colour slides he had taken during the tour.

This was followed by a tape recorded talk by Lawrie Blagbrough, VK4ZGL, on life and communications in the Thursday Islands.

The final feature of the evening was a discussion on an antenna question from a recent Amateur Operator's Certificate of Proficiency examination.

The Branch meets on the third Friday in each month at the School of Arts, Gosford. Visitors are always welcome to the meetings.

SOUTH WEST ZONE CONVENTION

The annual convention of the South West Zone of the New South Wales Division of the Wireless Institute of Australia will be held on the holiday weekend September 30-October 2, 1967. The venue for the weekend activities is Tumut in southern New South Wales.

Program:

Saturday 30th: Registrations and welcome to convention, all day at Tumut racecourse.

3.00-4.00 p.m.: Visit and inspection of Pyneboard factory.

6.00-6.30 pm: Registration and welcome to late arrivals.

6.30-8.00 p.m.: Convention Dinner at the Church of England Hall, River Street, Tumut.

8.00-11.00 p.m.: Social evening, Music and Dancing.

Sunday 1st: Field events and picnic lunch.
6.00 a.m.-3.00 p.m.: All band contest—Best log for the day.
6.00 a.m-3.00 p.m.: 7MHz Hidden Transmitter Hunt.
10.00 a.m.: Visit to Blowering Dam site.
11.00 a.m.-12.30 p.m: 144MHz Transmitter Hunt.
1.00-2.00 p.m.: Picnic lunch. Hot water and tea available, bring own utensils.
2.30-3.00 p.m: 144MHz transmitter Hunt for pedestrians.
3.00-5.00 p.m.: Results of contests and prize-giving.
Monday 2nd: Tour to Batlow—Kendall Fire lookout and return to Tumut. Farewells.

Registration fee: $1.50: Dinner $2.50, children under 10 years half price. Accommodation booking deposit $2.

Booking inquiries should be sent to W. J. Coombes, P.O. Box 69, Tumut, N.S.W. On-the-air inquiries can be made during the South West Zone hookup each Monday night at 8.00 p.m. on the 80-metre band.

For a pleasant weekend for the family—a trip to Tumut on the Convention weekend is recommended.

SOUTH AUSTRALIA

The large scale W.I.C.E.N. exercise conducted by the South Australian Division was very successful and has provided much useful information on suitable locations for the operation of communication links, should the need arise.

The area covered extended from the Adelaide hills to Victor Harbour, the mouth of the Murray River to Blanchtown and Clare in the north. This area includes the Mount Lofty Range, which has been subject to severe bush fires during dry summer periods. Links were also established across the St. Vincent's Gulf to Price and Moonta on the western side of Yorke Peninsula.

The Red Cross Society has invited the W.I.C.E.N. group to participate in a State Disaster Plan exercise organised with the approval of the relevant Government authorities.

The exercise will be concerned primarily with the care of persons who may be injured or rendered homeless in the case of civil emergencies. In such circumstances the W.I.C.E.N. mobile units would be particularly useful.

QUEENSLAND

The Ipswich and District Amateur Radio Club held the fifth annual meeting on Tuesday evening, July 11. There was a good attendance of members and visitors. In his report the retiring president, Norman Hart, VK4KO, referred to the excellent progress the club had made during the past year. The most ambitious project was the construction of the clubhouse.

The following officers were elected for the 1967-68 term:

President, Ron Grandison,	VK4RG
Sen. vice-president, Norm Hart,	VK4KO
Secretary, Phil Tomlinson,	VK4ZPE
Treasurer, Mrs Joan Lloyd,	——
Station manager, Wayne Bryce,	VK4ZN
News officer, Warren Heaton,	VK4GT
Public relations, W. Jehn,	WIA-L4001

Following the meeting, supper was served by the ladies, a highlight being the cutting of a club birthday cake by the Honorary vice-president, Mrs V. Jordan, M.L.A.

SUNSHINE CONTEST

This popular annual contest will be held on the 4th weekend in September. The rules will broadly be the same as for 1966. However, for full details, listen to the news broadcast from VK4WI each Sunday morning at 9 a.m. on 7146KHz in the 40-metre band.

WESTERN AUSTRALIA

The Western Australian Division of the W.I.A. holds its monthly general meeting in the Chemistry Lecture Room at the Perth Technical College, at 8 p.m. on the third Tuesday of each month, when interesting lectures on radio, electronics and allied subjects are a feature of the proceedings.

The VHF group meet at the D.C.A. Workshop's Canteen, 86 Guildford Road, Maylands, at 8 p.m., on the fourth Monday in each month. Generally, the theme in the lectures is on subjects associated with VHF techniques. Visitors are always welcome to these meetings.

VALE: It is with deep regret that we record the death of Mal Urquhart, VK6MU. An active amateur operator for many years, his sudden passing on July 28 was a shock to his many friends. Deepest sympathy is extended to his family in their sad bereavement.

YOUTH RADIO SCHEME

Up to recently, Youth Radio Scheme training by letter, has been conducted in the New South Wales Division under a Postal Group system. A re-organisation has now taken place. Correspondence training will be on a nation-wide basis under the auspices of the Youth Radio Clubs Scheme of Australia (Victorian Division).

The new plan will allow a uniform standard to be maintained at the various levels of study and a common syllabus established throughout the commonwealth. Administration has been streamlined and the old plan of innumerable stamped addressed envelopes is now redundant. A modest fee covers all services for the year including postage and the issue of course notes, etc. The old P-G Bulletin has now lapsed and is superseded by "CORYRA," as being the official magazine of the Correspondence Section.

To obtain more information about this excellent form of training — another service of the Wireless Institute of Australia — write to the following address:— The Secretary, Correspondence Section, Y.R.C.S., Roger Davis, 14 Hovea Street, O'Connor, Canberra City, 2601, A.C.T.

The organising committee of the Correspondence Section is:

Supervisor and Secretary: Roger Davis.

Treasurer: Miss Alison Stewart.

Training Officer: Howard Rider (Supervisor, Victorian Division of the Y.R.C.S.).

Liaison Officer with Y.R.C.S.: Michael Plummer (Secretary-Treasurer, Victorian Division Y.R.C.S.)

Publicity Officer: David Jeanes (Councillor of the N.S.W. Division).

CAMP TECHNOLOGY

Organised by the Inter School Christian Fellowship, Camp Technology will again be held at "The Grange" Mount Victoria, N.S.W. (in the Blue Mountains) during late December-early January.

This year it is proposed to hold separate camps for senior and junior students.

For full details of this highly successful project contact either:

J. Clark, 20 Darling Street, Chatswood, 2067, N.S.W.

or

R. E. Hockley, 18 Surrey Street, Epping, 2121, N.S.W.

NEW SOUTH WALES

An average of 20 boys attend the twice-weekly meetings of the St. Augustine's School Radio Club at Brookvale, all keen to learn and build various projects for their certificates.

Two of the newest call signs in the Newcastle area are those of Ray Robinson, VK2ZON and David Fraser, VK2ZYK. Both these young men have gained their licenses as the result of being members of Youth Radio Clubs.

Ray is a member of the Cessnock Radio Club and David is a member of the West-

(Continued on Page 160)

R.S.G.B. 21MHz & 28MHz CONTEST

Radio amateurs throughout the world are again invited to take part in the annual Radio Society of Great Britain 21MHz and 28MHz Telephony contest to be held on October 14 and 15, 1967.

1. Duration: The contest will start at 07.00 GMT on Saturday, October 14, and end at 19.00 GMT on Sunday, October 15.

2. Eligible entrants: The contest is open to licensed amateurs in all parts of the world.

3. Licence conditions: Entrants must operate in accordance with the terms of their licences.

4. Contacts: Contacts may be made using any telephony system for which the entrant is licensed. Contacts with unlicensed stations will not count for points. Proof of contact may be required. Only one contact on each band may be made with a specific station, whether fixed, portable, mobile or alternative address. Duplicate contacts must be logged and clearly marked as duplicates with claim for points. Cross-band contacts may not be claimed.

5. Contest Exchanges: An exchange of "RS" reports followed by a three-figure serial number starting from 001 for the first contact and increasing by one for each successive contact (for example, 58001, 56002, etc.) must be made before points can be claimed.

6. Operators: Only the entrant will be permitted to operate his station for the duration of the contest. Multiple operator entries will not be accepted.

7. Entries: Entries (a) should be clearly typed or written on one side only of foolscap or international A4 size paper. (b) Must be ruled in columns headed in the following order. Date/time (GMT); Call sign of station worked; I sent him; He sent me; Band; Bonus points; Total points claimed; (c) must be addressed to the Contest Committee, Radio Society of Great Britain, 28 Little Russell Street, London, WC1, England. The name of the contest must be clearly shown on the top left hand corner of envelope, which must be clearly postmarked not later than October 30, 1967. Logsheets are available from R.S.G.B. headquarters on request.

8. Scoring: British Isles stations may not work each other for points. Overseas stations may only claim points for contacts with British Isles stations (G, GC, CD, GI, CM and GW). Scoring will be as follows:

British Isles Stations: Each completed contact will score 5 points. In addition, a bonus of 20 points may be claimed for the first contact with each new country on each band. For the purpose of scoring, the R.S.G.B. countries list will apply, with the exception that VE, VK, W/K, ZL and ZS call areas will each count as a separate country.

Overseas stations: Each completed contact with a British Isles stations will score 5 points. In addition, a bonus of 50 points may be claimed for the first contact with British Isles country-numeral prefix on each band, i.e., G2, G3, G4, G5, G6, G8 GC2, GC3, GC4, GC5, GC6, GC8, GD2, GD3, GD4, GD5, GD6, GD8, GI2, GI3, GI4, GI5, GI6, GI8, GM2, GM3, GM4, GM5, GM6, GM8, GW2, GW3, GW4, GW5, GW6, GW8.

9. Awards: The Whitworth Trophy will be awarded to the leading British Isles entrant. In addition, Certificates will be awarded to the leading station in each of the other five British Isles countries, and to the runner-up in the Trophy winner's country. Certificates will be awarded to the leading station in each overseas country, VE, VK, W/K ZL and ZS call areas counting separately as in Rule 8, provided the log contains 20 or more valid contacts.

Sample Cover Sheet
R.S.G.B. 21/28MHz Telephony Contest
October 14-15, 1967

Name .....
Address .....
Transmitter .....
Receiver .....
Claimed Score .....
Call sign .....
Aerial (s) .....

Declaration: I declare that this station was operated strictly in accordance with the rules and spirit of the contest and I agree that the decision of the Council of the R.S.G.B. shall be final in all cases of dispute. I certify that the maximum input to the final stage of the transmitter was ..... watts.

Date..... Signed .....

Failure to sign the declaration may involve disqualification of the entry.

Receiving Section:

1. Eligible entrants: The contest is open to short-wave listeners throughout the world. All entrants agree to be bound by these rules. Only the entrant may operate his receiving station for the duration of the event. Holders of transmitting licences are not eligible to take part.

2. Duration: The same as for the transmitting section.

3. Entries: (a) To count for points, logs must show, in columns: (i) Date/Time GMT; (ii) Call sign of station heard; (iii) Report and serial number by station heard; (iv) Call sign of station being worked; (v) Band in MHz; (vi) Bonus points claimed; (vii) Total points claimed. CQ or test calls will not count for points.

(b) Entries should be set out and addressed as for transmitting.

(c) All entries must contain the following declaration: I declare that this receiving station was operated strictly in accordance with the rules and spirit of the contest and I agree that the decision of the Council of the R.S.G.B. shall be final in all cases of dispute. I do not hold an amateur transmitting licence.

Date..... Signed .....

4. Scoring: British Isles entrants may only log overseas stations working United Kingdom stations in the contest. Overseas entrants may only log British Isles stations in contact with overseas stations in the contest. A station whether fixed, portable, mobile or alternative address may be logged only once per band for the purposes of scoring. CQ or test calls will not count for points.

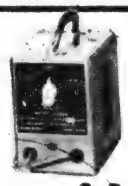
British Isles entrants: Each complete log entry will score 5 points. In addition a bonus of 20 points may be claimed for the first station logged in each new country on each of the two bands (21MHz and 28MHz). For the purposes of scoring the R.S.G.B. countries list will be used, with the exception that VE, VK, W/K, ZL and ZS call areas will count as separate countries.

Overseas Entrants: Each complete log entry relating to a British Isles station heard will score 5 points. In addition a bonus of 20 points may be claimed for the first station heard in each British Isles country-numeral prefix on each band as listed in rule 8 for the transmitting section.

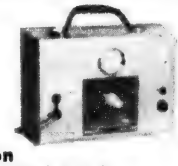
5. Awards: At the discretion of the Council. the Metcalfe Trophy will be awarded to the leading British Isles entrant. In addition, certificates will be awarded to the British Isles runner-up and to the leading entrant in each overseas country.

6. The Council of the R.S.G.B. reserves the right, on the recommendation of the Contest Committee, to reject any entry that is consistently inaccurate.

The closing date for posting entries is October 30, 1967.



BATTERY CHARGER



240 Volt A.C. Operation

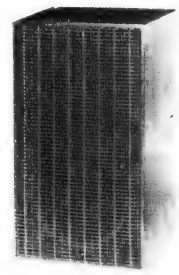
3 Rate 6V, 12V TRICKLE CHARGE

Trickle Charge Position suits all Batteries. 2V to 12V at rate of 200 to 500 M.A.

STANDARD		DE LUXE	
2 amp. 6V, 12V, TRC ..	$11.50	3 amp.	$16.75
3 amp. 6V, 12V, TRC ..	$12.25	4 amp.	$19.75
4 amp. 6V, 12V, TRC ..	$15.25	6 amp.	$21.75
		10 amp.	$27.75

Post. N.S.W. 75c. Interstate $1.25. Rail or Air Freight on.

MULLARD MAGNAVOX



BOOKSHELF ENCLOSURE
Maple, Teak or Walnut
Complete $26.00
SUPER BOOKSHELF $40.50
Post: N.S.W. 50c, Interstate $1.00.

PLAYMASTER BOOKSHELF UNITS

6in	8in	12in
$29.50	$33.50	$36.50

GUITAR AMPLIFIERS

10-Watt, Two Channel, with Twin Cone Speaker .. $53.55 £26/15/
14-Watt, 4 Inputs, Bass and Treble Boost. 2 Twin Cone Speakers .. $63.00 £31/10/
17-Watt, Four-Channel, Bass and Treble Boost. Two Twin Cone Speakers $76.25 £38/2/6

35 WATT

4-Channel. Bass and Treble Boost. 4 Twin Cone Speakers $109.05 £54/10/6
Vibrato with foot control and 2 preset controls for frequency and intensity. $10.50 (£5/5/) extra on above models.

14 plus 14 WATT

With Reverberation. May be used as 28 Watt or as 14 Watt plus 14 Watt Reverb. Two 9 x 6 Woofer Speakers. Two 9 x 6 Twin-Cone Speakers. 4 Channels. Bass and Treble Boost. Foot Vibrato control included.

$163.50 £81/15/-

SLAP BASS OR BASS GUITAR 40 WATT AMPLIFIER

4 Input Channels. Bass and Treble Boost. Two 12in Radial Beam Speakers. Perfect reproduction on 20 cycles.

$159.75

PIGGY BACK GUITAR AMPLIFIER

30 Watt	$79.75
45 Watt	$99.75
60 Watt	$119.75

4 Inputs. Bass and Treble Boost. Vibrato if required, $10.50 extra.

PLAYMASTER 116

GUITAR AMPLIFIER

Kit Set	$79.95
Wired and tested	$91.95

PLAYMASTER 117

60 Watt.

$99.95

Wired and tested, $111.95.

REVERBERATION-PRE-AMPLIFIER

2-Channel input. Fully transistorised. A.C. Powered.
Plugs into and matches any Guitar, Organ or P.A. Amplifier.

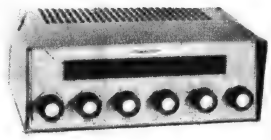
£29/17/6 $59.75

TAPE ECHO UNIT

Suits any Guitar amp. without any alteration.
JUST PLUG IN.

$139.50

PLAYMASTER 106 AND 107



Feb. and March Elect. Aust.

106

WIRED AND TESTED. **$88.75**

107

WIRED AND TESTED **$79.00**

V.T.V.M. MODEL TE-40 MILLIVOLTER

Spec. AC.V. Imv.—300 Vrms. 10 ranges. Accuracy 5 cps—1.2 mc, plus-minus 2dB, 10 cps-1 mc. plus-minus 1dB. 20 cps-250 KC., plus-minus 0.2dB.
dB. Scale: 40-30-20-10.0, 10.20, 30.40, 50 dBm. 240 V.A.C.

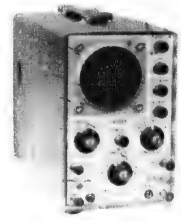
$47.50.

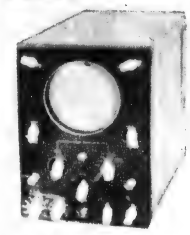
MODEL TE-65 V.T.V.M.

DC.V 0-1.5-5-15-50-150-500-1500 V. Rms. AC.V. 0-1.5-5-15-50-150-500-1500 V Rms. 0-1.4-4-14-40-140-400-1400-4000 V. P.P.
Resistance RX10.100, .1K, .10K, .100K, .1M, .10M. Decibel—10db, minus-plus 65dB.
240 V.A.C.

$42.50

TEST EQUIPMENT



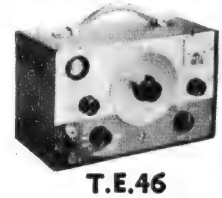


WIDE BAND OSCILLOSCOPE

5 Meg. Bandwidth. Push-pull vertical and horizontal Amplifiers. 8 position, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard-time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

3-inch $99.75; 5-inch $111.50

T.O.2 TV portable service unit 2" oscilloscope $59.50.
C.R.O. DOUBLE BEAM SWITCHING UNITS $39.75



T.E.46 RESISTANCE-CAPACITANCE

Bridge and Analyser.
Capacity 20 pfd to 2,000 mfd. Resistance 2 ohm to 200 megs. Also tests power, factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs. at 600V.
Indications by eye and meter.

$47.75

PLAYMASTER 4 STEREO AMPLIFIERS

Push-Pull. 8 Watt per Channel. Bass and Treble Boost and Cut, Wired and Tested.

$77.00

ELECTRIC GUITAR

Pickup Units	$8.75
Accordion Pickup Units ..	$8.75
Harmonica Pickup Units ..	$1.95

Post. N.S.W. 40c; Interstate 75c.

SIGNAL GENERATOR

Deluxe Model TE 20D.

Freq. range 120 KC—500 Mcs. 7 Bands. Accuracy 2 per cent. Output 3V. Provision for Xtal. Suitable for self calibration. Marker generator. Printed circuit. 240 V.A.C.

$27.50

Post., N.S.W., 75c; Interstate $1.25

T.C. 2

VALVE TESTER

Tests all valves, diodes, rectifiers, checking filaments, shorts. Merit on direct reading. Good-bad meter. Complete with tube chart.

$26.75

Post, N.S.W. 25c; Interstate $1.25.

T.E. 50.—99—5011

Checks, Nu Vistas, Compactrons, etc.

$34.25

G.D.O. UNITS

Leader. 810. 6-Band. 2 Meg to 260 Meg Nuvistorised, 240 V.A.C. Operation. Modulated. Calibration. Accuracy 2 per cent.

$41.50

T.E. 18 Lafayette. 8 Bands. 360 K.C. to 260 Megs. 240 V.AC. operation

$39.50

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T.E. 15 Transistorised. 7 Band. 360 Kc to 270 Megs.

$34.75

AUDIO GENERATOR

DeLuxe Model TE—22D.

Freq. range. Sine 20 cps—200 KC. SQ. 20 cps—25KC. Output voltage. Sine 7V. SQ. TV P-P. Output impedance 1000 ohms. Acc. 5 per cent. Distortion less than 2 per cent. 4-range attenuation. 1/1, 1/10, 1/100, 1/1K. Printed circuit.

240 V.A.C.

$41.50

Post. N.S.W $1.00; Interstate $1.50

PLAYMASTER 115

The new solid state Stereo-Amplifier. April Issue.

Wired and Tested	$104.00
Kit Set	$90.00
Pre-amp to suit magnetic cartridge	$12.00

PLAYMASTER 118

Wired and tested $83.50.
Fitted with Pre-Amp to suit Magnetic Cartridge.

$95.50.

YOUTH RADIO SCHEME

(Continued from Page 157)

lakes Radio Club. They are now busy preparing to put their stations into operation on the VHF bands.

QUEENSLAND

The number of very active clubs registered with the Y.R.S. in Queensland has grown to nine. Inquiries with the view of forming clubs have been made from Townsville and Clayfield. Also from Rev. Bro. Freitas, VK9ZAF, who is forming a club at the Catholic Mission, Mongop, New Ireland.

Five members of the Bundaberg Club and three of the Church of England Grammar School Club have recently gained their elementary certificates, while three from Gympie and one from C.E.G.S. their Elementary certificates. It is interesting to note that D. Russel and R. Taylor of C.E.G.S. gained Honour Passes.

All inquiries to Youth Radio Scheme, Queensland Division, should be addressed to: D. Dwyer, c/- D.C.A., T.T.S., Box 1, Brisbane Airport, 4007, Queensland.

SOUTH AUSTRALIA

Nine members of the Elizabeth Amateur Radio Club have gained their Youth Radio Scheme, Elementry certificate, the average pass being 82.4 per cent.

The record of the Port Pirie Club now stands at 21 elementry certificates, three junior certificates and two Amateur Operators Limited Certificate of Proficiency.

Plans are in hand to form Y.R.S. Clubs at Gladstone and Wallaroo. Details of Y.R.S. activities in South Australia may be obtained by writing to the Supervisor Y.R.S., Box 1234K, G.P.O. Adelaide, 5001, South Australia.

The average of twenty boys attend the twice-weekly meetings of the St. Augustine's School Radio Club at Brookvale, all keen to learn and build various projects for their certificates.

W.A.H.C. CERTIFICATE

(1) The Radio Association Ecuatoriana offers the Worked all "HC" call areas — W.A.H.C. — Certificate to all licensed amateurs who verify having had two-way contact with at least seven (7) Radio Districts in areas within the Republic of Ecuador.

(2) It is permissible to use all bands available to amateurs either CW or phone.

(3) For verification it will be necessary to state the Radio Clubs from which the QSL cards were received, together with a list of the stations worked to: Association Radio Ecuatoriana, Post Office Box 289, Quito, Ecuador, South America.

(4) The contacts must have taken place after November 1945, the time when most of the countries on the continent re-opened after the wartime close-down.

The Radio Districts of the Republic of Ecuador are as follows:—

HC1—Districts of Carchi, Imbabura and Pichincha.

HC2—District of Guayas and the rivers.

HC3—Districts of Loja and El Oro.

HC4—Districts of Manabi and Esmeraldas.

HC5—Districts of Chimborazo, Canar andAzuay.
Azuay.

HC6—Districts of Cotopaxi, Tungurahua and Bolivar.

HC7—Districts of Napo Pastaza and Santiago Zamora.

HC8—The Colon Archipelago (Galapagos Islands).

R.S.G.B. Loss. It is with deep regret that the President and Council of the Radio Society of Great Britain record the death of John Rouse, G2AHL, general manager and secretary of the society. John died at his home on Friday, May 26.

Australian amateurs who have read the R.S.G.B. Bulletin know John as the Editor. The sympathy of all amateurs is extended to his family in their sad bereavement. ■

LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

RSA Service for Australasia

Radio South Africa announced recently a new service for listeners in Australia and New Zealand as part of its plans for continued expansion.

A letter from Mr A. J. Jooste, head of the External Services of Radio South Africa, informs us that the station has plans for transmissions to Australia and New Zealand, and these will be put into operation shortly. The station also has plans for a monthly newsletter to be sent to listeners. This will contain information on the station, personnel and programs.

The RSA transmissions commenced with its official opening in October, 1965, by the late Prime Minister of South Africa, Dr H. F. Verwoerd, and since May, 1966, the station has been beaming its programs to Africa, Europe and America, using the slogan "The Voice of South Africa." The station operates from a site 40 miles south of Johannesburg. It has four 250W transmitters and an aerial array providing 38 various beams with push-button aerial selection. The North American beam can be slewed to cover Australia and New Zealand.

ASCENSION ISLAND RELAY

Further details have come to hand on the BBC Ascension Island relay base, which with its four 250KW short-wave transmitters, is relaying programs to Africa and South America. Time difference is such that the station can be used efficiently to service both areas. Ascension Island receives the signals beamed from Britain, for rebroadcasting. The station began to test in June, 1966, and in February this year began its regular service to Africa and South America. Programs in English, French and Hausa are beamed to West Africa; and in Spanish and Portuguese to South America. Additional aerials are soon to be constructed and when these are completed, the beam will be available for Central Africa and Central America. Early next year the service is to be extended to cover South Africa and the Caribbean areas. Some of the programs and frequencies in use by Ascension Island are:

World Service, to Africa: 0400-0915GMT on 11820, 11860KHz; 0400-0715GMT on 15235, 9600Hz; 1715-2115GMT, on 9580, 11820, 15400, 15105KHz (the latter 1700 to 1830GMT).

Programs to South America: 2200-2300-GMT on 11865, 2300-0330 15140, 0230-0415 on 15140KHz. The BBC will be pleased to receive reports on the signals from Ascension, sent to the BBC External Services Engineering, Bush House, London, W.C.2, England.

SCHEDULE FROM ATHENS

Seldom heard in the Australasian area is the Hellenic National Broadcasting Institute, P.O. Box 360, Athens, due to the fact that its services are intended for European reception. Programs in Greek are 0700-0815, 1030-1300, 1330-1515, 1630-1700, 1830-1900GMT using 7295, 9605KHz; and 1730-1800, 2200-2230, 2300-2330GMT on 11720, 15345KHz.

The station also operates a service to Western Europe 1730-1800GMT and 1930-2100GMT on 11720, 15345KHz. Programs mainly consist of national music and news.

RADIO EL CONDOR—CP18

Reception of the Bolivian station Radio El Condor on the new channel of 6070KHz is widely reported. The signals are heard in New Zealand from as early as 0245GMT and are blocked at 0400GMT by Radio Sofia, Bulgaria, using the channel. CP18 is listed in the World Radio Handbook as using 6055KHz, but this change in its frequency has made reception possible. Dene Lynneberg, of Wellington, N.Z., reported this change, and our own observations have confirmed it. The station has news in Spanish at 0325GMT and its slogan is given frequently. The station address is Radio El Condor, La Plata 1139, Oruro, Bolivia.

VUNC ON OKINAWA

The Voice of United Nations Command, as well as carrying its programs from South Korea, has a 20KW transmitter in Okinawa which has the same program area, namely North Korea, and the Asian area in general. The station at Okinawa verifies reception by a card, and it is using 9418 and 13830KHz.

Program schedule from VUNC Okinawa in Mandarin is 0605-0700, 0920-1020, 1035-1200, 1400-1530, 1730-1900GMT. Korean is 0700-0920, 1230-1400, 1600-1730, 1930-2100GMT. Cantonese is 1020-1035, 1200-1230, 1530-1600, 1900-1930GMT.

SOUTH KOREAN SERVICES

The transmissions of the Korean Broadcasting Service in Seoul are frequently heard in the South Pacific area, with its home program on both medium and short wave.

Seoul 1, HLKA, on 710KHz 500KW, 2510KHz 10KW, 3713KHz 5KW, 5975KHz 10KW.

Seoul 2, on HLKA, 600KHz 10KW.

Kukje, HLSA, on 970KHz 100KW.

On short wave: HLK31, 6015KHz, 50KW; HLK53, 6035KHz, 10KW; HLK5, 96040KHz, 50KW, HLK41, 15430KHz, 50KW. Pusan, HLKB, on 890Hz with 50KW is one of the medium-wave stations. The program schedule on Seoul 1 is 2000-1700GMT, and Seoul 2 operates 2000-1700GMT also.

The World Radio bulletin reports that the station of the Chonggu University, Taegu, is operating an experimental service on 7065KHz with 10W, in English and Korean. The schedule of the station is not known.

ELWA MONROVIA LIBERIA

The present transmission schedule from Radio ELWA in Monrovia, Liberia, is to hand with its usual verification card. It shows an extended use of new frequencies in all bands, and is now operating as follows:

To Central Africa on 11950KHz 50KW, 17760KHz 1KW, 21535KHz 5KW; 0455-1645GMT, with programs in English, French and Nigerian. English is 0600-0715, 1530-1645GMT.

To Liberia on 710KHz 1KW on medium wave, and 3225KHz 10KW; 0615-0815, 1800-2245GMT.

To West Africa, 4770KHz 10KW; 0610-0815 (English), 1740-2250GMT.

To Middle East, 15155KHz 50KW, 17760KHz 1KW; 1655-1800GMT.

To Congo and East Africa, 15155KHz 50KW, 17760KHz 1KW; 1800-2000GMT.

To North Africa, 15155KHz 50KW; 2000-2200GMT.

To South Africa, 15155KHz 50KW; 2200-2300GMT.

CFCX MONTREAL

Verification card from CFCX in Montreal, on 6005KHz with 500 watts, gives the history of this long-established station. CFCX was originally licensed as VE9DR, operating from Drummondville, Quebec, from 1930 to 1932. The location was then changed to the Mount Royal Hotel in Montreal, and the callsign became CFCX. From 1936 to 1948 the station operated from Montreal. In 1963 the station recommenced operating with a relay of CFCF from the present site at Caughnawaga, Quebec, using a lazy H beam.

The key station CFCF was the first broadcasting station in North America, having started in 1919. It uses Gates-Marconi equipment, and is operated by Marconi Radio and Television. The station has four 300ft towers in a directional pattern, and is located on the Iroquois Indian reserve of Caughnawaga, Quebec, across the St. Lawrence from Montreal.

The station also operates CFCF-TV on Channel 12 and CFCF-FM using 92.5MHz. The station on CFCX is heard at 0900 and the usual announcement is "This is Radio CFCF, on 600 kilocycles." The verification card is white with red band and CFCF in large type. The address is Radio CFCF, 405 Ogilvy, Montreal, Canada.

ENGLISH FROM BUDAPEST

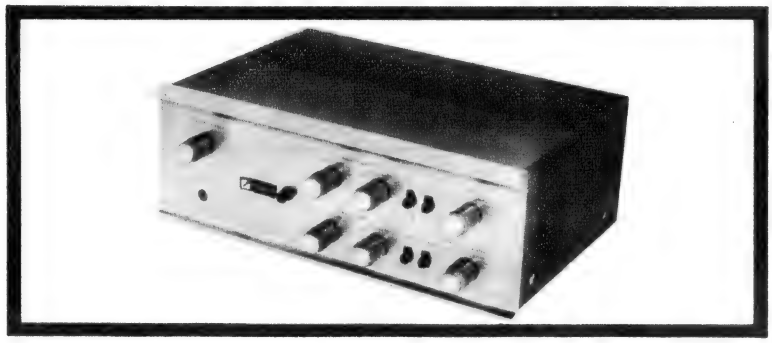
English transmissions of Radio Budapest in Hungary are beamed to Europe 1930-2230GMT on 21685, 17890, 15160, 11910, 9833, 7220, 7100, 6234, 3995KHz. From 2330-2400GMT transmission is on 6234, 3995KHz.

Transmissions to North America, Australia and New Zealand are 0030-0100GMT on 15160, 11910, 9833, 7220, 6234KHz; also 0300-0400GMT, 0430-05GMT on the same frequences.

The DX session from Radio Budapest is on the air, on an experimental basis, to the Far East, Australia and New Zealand, every Wednesday and Friday. On Wednesday, transmission is 800GMT and Friday 1015-GMT, on 17890, 15160, 11910KHz. Reception reports on this special transmission would be appreciated by Radio Budapest, Hungary.

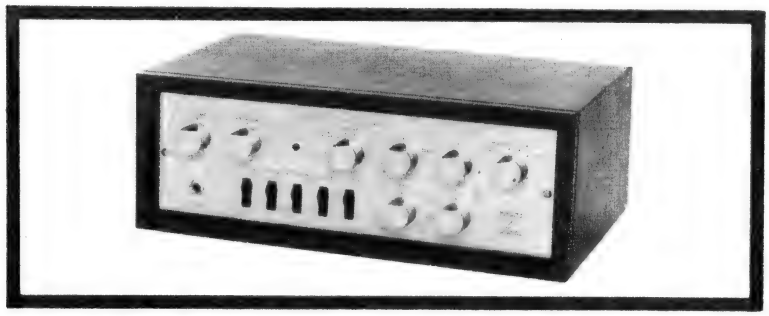
CHANGES FROM COLOGNE

Radio Deutsche Welle in Cologne, Germany, made some frequency changes last month, and now have German to Europe 0645-0945GMT on 6100KHz; German to South America 2230-0130GMT on 15410-KHz; Portuguese to South America 2140-2230GMT and Spanish, 2230-2350GMT, on 15435, 11795 and 9545KHz. The English transmission to Australia and New Zealand 0845-0940GMT is on 11925, 15275 and



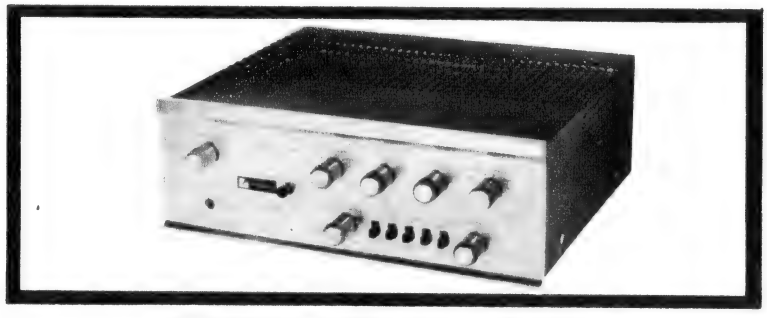
THE LUX SQ-101 SOLID STATE STEREO AMPLIFIER—$189

This fine silicon transistor stereo amplifier is rated at 80 watts peak power output and distortion is negligible at normal lounge room listening levels. Frequency response is 15-50,000 Hz. plus or minus 2 dB. Magnetic sensitivity is 3.5mV, tape head input 1.8 mV and additional features include unique bass and treble control circuitry permitting changeable crossover frequencies for both high and low ranges. High cut (scratch filter), low boost (loudness control), tape monitor, speaker switch, headphone jack and normal treble/bass controls are standard. Used with 16 ohm speaker systems power output is 15 watts R.M.S. per channel. The audio excellence of the SQ-101 is obvious even to the untrained ear. Earlier substantial shipments sold out in a few days! **$189**



LUX SOLID STATE STEREO AMPLIFIER—THE MODEL SQ77T $149

Using silicon power transistors the SQ77T is rated at 15 watts R.M.S. in each channel with an 15 ohm speaker load. Frequency response is 15-50,000 Hz. plus 0, minus 3 dB. Input sensitivity is 1.8 mV for magnetic pickup or tape head, aux. inputs being rated at 200 mV and 800 mV. Controls include stereo volume, stereo balance, mode switch, treble and bass (separate controls for each channel), input selector, headphone jack and switch, tape monitor switch, rumble and scratch filter switches, etc. Use of advanced circuitry and ultra modern solid state devices results in complete reliability and unique musical performance. $149.



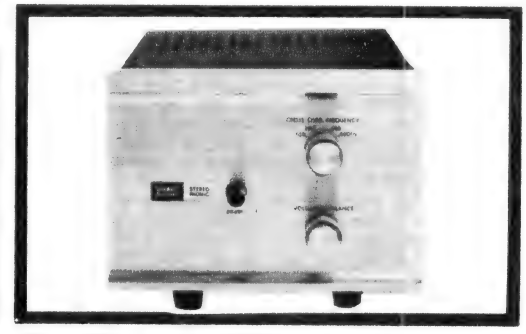
THE LUX SQ 65—30 WATTS R.M.S. PER CHANNEL

With a wide frequency response of 20-20,000 Hz. plus or minus 1½ dB. at full output, the circuitry of the SQ 65 incorporates silicon diodes and P.P. 7868's, output being 30 watts R.M.S. in each channel. Input sensitivity is 4 mV. for magnetic p.u. Tone compensation circuits include a U.S. patented M.F.B. system and new Lux NF electronics. Substantial grain oriented output transformers of unique design are responsible for the outstanding performance of the SQ 65. Features include tape monitoring circuit, phase switch, blend control, speaker switch, headphone jack, scratch filter and rumble filter. The MFB circuitry is effective on normal speaker systems. Write for complete specifications **$199**

LUX

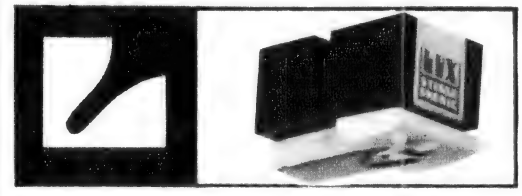
SETS NEW PERFORMANCE STANDARDS

New vistas in electronics have been opened by the research division of the Lux Corporation, Japan's leading manufacturer of high quality amplifiers and associated equipment. Engineering and wiring are most meticulous as detailed examination discloses. The NHK Broadcasting Network use Lux amplifiers—and the Olympic Stadium in Tokyo was equipped with Lux public address systems. Much Lux electronic circuitry carries world wide patents and is exclusive to Lux amplifiers. As Australian agents, Encel Electronics Pty. Ltd. has selected a number of Lux models; in every case the unit offers remarkable value and is fully guaranteed.



LUX MODEL FL-15 CHANNEL CONTROL

The FL-15 is a frequency divider network designed for multiple amplifier systems, with crossover points at 100, 200, 400 and 800 Hz. Three terminals are also provided for 3-D sound systems. In every way the FL-15 is superior to normal conventional crossover networks; speakers with differing efficiency and impedance may be matched, amplifier stability is improved, triode amplifiers are used for medium and high frequencies and more powerful amplification is used for the low registers. Contact us for full details, specification and price.



NEW MOVING MAGNET STEREO CARTRIDGE

The Lux T-15-M has been acclaimed as a brilliant performer by discriminating audio enthusiasts—frequency response is conservatively quoted at 20-20,000 Hz. and stylus pressure is from 1 to 2½ grams. Tracking angle is 15°, output is 5 mV. at 1 kHz. Stylus sizes available are the 0.7 mil. conical diamond and the new elliptical diamond (T-15-ME). From a musical appreciation point of view the Lux T-15-M compares favourably with cartridges twice the Encel price . . . T-15-ME: $29.50.
T-15-M (conical diamond stylus) **$24.50**

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Australia's Greatest Hi-Fi Centre
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17845KHz; also 211-2200GMT on 7290 and 9695KHz. Cologne's service to North America is in English in several transmissions; best reception is 0445-0545GMT using 9735 and 11945KHz. The German program to Australia and New Zealand 0645-0945GMT is best received on 11795-KHz.

RADIO PYONGYANG ENGLISH SERVICE

Broadcasts from Radio Pyongyang in North Korea has signals beamed to some parts of the world, but the station is notorious for its off-band channels, outside the international short-wave bands.

Area	GMT	KHz
Near Middle East,	1900-200	6540, 15520
Africa	0400-0500	6540, 15520
South-East Asia	0800-0900	6480, 7580
	1100-1200	6480, 7580
	1400-1500	6430, 7580

On Saturday the station has its program "At Your Request," during which music requested by listeners is played.

RADIO BERLIN INTERNATIONAL

Radio Berlin International, the East German station with studios in Berlin, has been in operation for 12 years, having commenced its short-wave services in April, 1955. Now broadcasting in 10 languages with transmissions exceeding 50 hours daily, the station is well received in all parts of the world. The station has issued a new QSL verification card which shows prominent German sportsmen and sportswomen. The station also has its own DX Club, founded in February, and this program is carried in all Saturday broadcasts in English.

The service from RBI Berlin to South-Asia, Australia and New Zealand is 0645-0730GMT on 17700; 1200-1245 on 17700, 17880 (from Sept. 1 replaced by 21610) 1315-1400 on 17880 (replaced on September 1 by 21610); 1415-1500 on 17700KHz. On Saturday the transmission 1225-1245GMT is replaced by an Indonesian session.

4XD — N.Z.'s Only Private Broadcaster

Following a report in "Broadcast Band News" in our January, 1967 issue, on Station 4XD, New Zealand's only surviving private broadcaster, a letter has been received from the station's technical officer, Mr P. J. Holden, about the operation of 4XD and its equipment.

The following is extracted from Mr Holden's letter:

The Otago Radio Association came into being early in 1922 for the purpose of bringing together persons with an interest in radio generally, and in broadcasting in particular. The result of the inaugural meeting was the ultimate establishment, on October 4th, 1922, of what is now 4XD. As Mr Cushen suggests, 4XD is the only surviving private radio station from about 30 in operation until 1937. About this time, the majority of them were taken over or closed down by the Government, leaving a mere half dozen in existence. Over the years, these have passed from the scene one by one.

The programs of 4XD are not as suggested in your January issue "mainly Gospel" but predominantly secular and of a light varied nature. The Sunday morning schedule is however given over entirely to religious matters. The present hours of operation are Wednesday and Thursday, 6 p.m. to 10.45 p.m.; Saturday, 7 p.m. to 10 p.m.; Sunday, 9.30 a.m. to 12.30 p.m. and 7 p.m. to 10 p.m.

The present transmitter is a reconstructed RCA ET 4336 B communications transmitter with a nominal output of 250 watts. The frequency is 1430KHz, from a Colpitts temperature controlled crystal oscillator 6J5, 6ACG7 buffer, 6AG7 Class A stage to 807—to two 813s in Class C paralleled in a bridged T output circuit. Aerial tuning is Pi-network, into a Marconi quarter-wave inverted L cage about 85ft high. The audio setup consists of an eight-channel 600 ohm mixer with preamplifiers 6SN7-6SN7 to Class A 6L6GC driving 805 Class B modulators. Pickups have frequency correction amplifiers and two converted 2425 tape recorders ex NZBC serve for tape replay machines. For outside broadcasts, Ferrograph portables are used and, on occasion, relay line facilities also.

4XD's mixer panel.

LATIN AMERICA NEWS

MARTINIQUE: ORTF, Fort de France, using 3315KHz, is now opening at a new time, the transmission being heard in New Zealand from 1005GMT. The station opens regularly, has an interval signal and then "La Marseillaise" and identification announcement in French.

COSTA RICA: TIQ Radio Casino, Puerto Limon has verified reports in three weeks. The station confirmed with a letter and pennant, and returned the International Reply Coupon. The station uses 5954KHz and closes in English at 0600GMT.

VENEZUELA: YVRA Radio Monagas opens at 1000GMT on 3325KHz with a Spanish program. YVPA have moved from 4880 to 4940KHz, and is announcing power as 20KW. The station, with slogan Radio Yaracuy, San Felipe, operates 1000-0400-GMT.

PERU: Station OBX4M Radio Panamericana, Lima, is noted at 1130GMT with typical Spanish programs on 5980KHz, and sign off is noted at 0345GMT.

OAX4Q Radio Victoria in Lima is on 6020KHz and sign off is 0658GMT, with full station identification, reports Theo Donnelly, Hamilton, and Dene Lynneberg, of Wellington, N.Z.

GUATEMALA: TGNA Radio Cultura, Guatemala City, is now again active on 5955KHz. The station schedule on this frequency is 1200-0300GMT. On 9668KHz, which has the schedule 0300 to 0400GMT, power of the station is 5KW. The station is owned by the Central American Mission, Apatado 601, Guatemala City. The station call TGNA is used as its slogan "Telling Good News Abroad." English transmissions are 0300-0400GMT on 9668KHz.

FLASHES FROM EVERYWHERE

EUROPE

PORTUGAL: Emisora Nacional in Lisbon, now uses the new frequency of 9585KHz. Signals have been observed in Portuguese before 2300GMT. The DX program of Radio Portugal (known as Radio Safari) is carried in all English transmissions from Lisbon. The Radio Safari segment is contributed by Richard Gimbey, of Vanderbigl Park, South Africa. The transmission times are Tuesday, 0215GMT and 0400GMT. The program is also heard on Mondays over Sao Tome on 4807KHz at 2200GMT, and in the service to Australasia at 0845GMT on 17740 and 21490HKz.

VATICAN: Radio Vatican in its transmission to North America has English 0050GMT and French at 0110GMT on 15285KHz. The South American transmission is on 17860KHz with Portuguese at 2200, and Spanish at 2330 and 2400GMT.

U.S.S.R.: Radio Vilnius is now in English on Friday and Sunday at 2100-2130GMT, and 2230-2300GMT using 11730, 11970, 15210, 15260, 15460KHz.

GREECE: The Voice of America has resumed broadcasting from its relays in Greece, after a period of silence. The VOA stations at Thessaloniki and Rhodes are now being heard with normal scheduled programing. Rhodes is observed on 1259KHz medium wave at 1600GMT, while Thessaloniki is heard on the new channel of 6000KHz at 1800GMT. The medium wave Thessaloniki station is on 791KHz, operating 0430-0630, 0700-1530, 1545-2200GMT.

AFRICA

TANZANIA: "World Bulletin" reports that Radio Tanzania, Dar es Salaam, is heard on the new frequency of 4915KHz at 1750GMT in English and Swahili, and identifies at 1800GMT as the International Service of Radio Tanzania. The station also is reported to operate several differ-services in Swahili; one service is on 3250, 5050, 7160, 9530KHz, a second network is on 5985 and 9550KHz, and a third service is on medium wave 638KHz. Each begins transmissions at 0300 but with different programs. The second program is now known as the English Service of Radio Tanzania. The External Service is still 5050KHz and 15435KHz.

NIGERIA: Radio Nigeria, Lagos is heard on the new frequency of 4935KHz in English at 0525GMT. The transmitter is located at Benin, according to station verification. The Mid-West Regional Service of the Nigerian Broadcasting Corporation is on the air 0500 to 1000, 1400 to 2100GMT, using stduios at Benin City, with 5KW on 638KHz medium wave, and 10KW on 4935KHz. The West Nigerian Broadcasting Service, Ibadan, is using 6050KHz, to close down at 2300GMT.

CENTRAL AFRICAN REPUBLIC: Radio Bangui has news in English at 1930GMT on Sunday, and 2000GMT weekdays. The station operates on 5035KHz, and is received with this program by listeners in Australia and South Africa.

CONGO: "La Voix de la Fraternite Africaine" (Voice of African Brotherhood), from Lubumbarhi, on 11866KHz, is on the air with programs as follows: 1500-1600, 1700-1800, 2000-2100 in French; 1600-1700 in Swahili; and 1800-2000 GMT in English.

UGANDA: Radio Uganda at Kempala is to expand its radio and television services, and also plans to introduce an external service. The station recently has been heard on 4976KHz at 1900GMT with fair level.

ZANZIBAR: Radio Zanzibar is on the air 0345-0500 on 4911KHz (120KW), and

New Electrolytic Condensers

These condensers are miniature pigtail type insulated new stock in packets of 12, each packet containing; 3, 16mfd 300V.W., 2-32 mfd. 300V.W., 1 25mfd. 450 V.W. and 6 low voltage electrolytics. **$2.50.**

Post and packing 20c extra.

NEW IMPORTED 4" P.M. SPEAKERS

Available with a 4 or 16 ohm voice coil. **$2.50.**
Post and packing 30c extra.

NEW IMPORTED SLOT CAR KITS AT LESS THAN HALF PRICE

Complete kit of parts including 12V motor and full instructions.

$2.50 post 25c

Imported National Transistorised Shoulder Megaphone

These shoulder megaphones manufactured by National Radio Japan have an output of 4 watts, and are supplied complete with inbuilt horn type speaker, batteries and microphone. List price $78.

Special Price $50. Post extra
Other types also available.

NEW AMERICAN TWIN TELESCOPE TV AERIAL
Extends to 36in, each section can be used singly for car or portable .. $1.50. Post 20c.

SINGLE TELESCOPIC
Aerial 12in extends to 33in. 60 cents. Post 10 cents.

NEW 4-SPEED STEREO PLAYER F.O.R. $17.50

NEW STEREO CHANGER. 4-SPEED F.O.R. $21.50

SLIDER-SWITCHES
10 pole 2-way silver plated contacts 38c

POWER TRANSFORMER

Prim. 240V Sec. 350 volts a side. 60 M.A. One 6.3V, one 5V F11.

$2.75 Post N.S.W. 60c, Interstate 80c.

72 ohm CO-AXIAL CABLE

20c per yard. Minimum order 5 yards.

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt at 4 amp., $3.75. Post, N.S.W., 20c; Interstate, 20c. Transformer for above rectifier tapped for 6 to 12 volt, with circuit for charger, $4.75. Post, N.S.W., 75c; Interstate $1.00.
As above, 6 or 12 volt, at 2 amp., $2.75. Post, N.S.W., 35c; Interstate, 45c. Transformer for above, $3.75. Post, N.S.W., 35c; Interstate, 45c.

NEW 240V. A.C. MOTORS

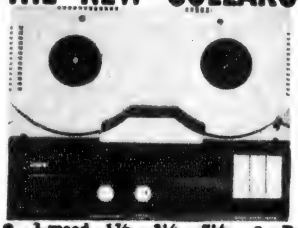
These small motors, size 5in x 3in x 3½in, are 1-12 h.p., but are only suitable for intermittent use. $2.95. Post N.S.W. 35c; Interstate 50c.

POCKET COMPASSES for Hikers, Scouts, etc. 35c

NEW EXTENSION SPEAKER FITTED IN ATTRACTIVE LAMPBASE

FOR TRANSISTOR SETS
SUPPLIED WITH LEAD and PLUGS TO SUIT MOST SETS
(Shade not supplied).
$5.00
Post and packing 75c.

THE NEW COLLARO 3-SPEED 4 TRACK TAPE-DECKS $48.00



The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

● 3-speed 1⅞, 3¾, 7½. ● Pause control. ● Takes 7in. spools. ● Simplified controls. 4 Tracks, $48; OSC Coils, $1.50.

NEW 4" EXTENSION SPEAKERS

These 4" speakers are mounted in polished cabinets suitable for use as intercom, units or extension speakers. LIST PRICE **$12**

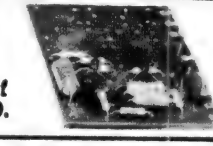
SPECIAL PURCHASE ENABLES US TO SELL THESE UNITS AT $4.

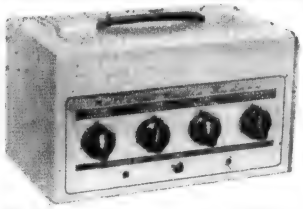
Post and packing, N.S.W., 68c. Interstate, 90c.

A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS

Using 3 silicon transistors as featured in October Electronics Australia complete with kit of parts including transistors mono **$7.50**, stereo **$13.00**, 240 power supply for above **$7.00.**
Please specify if required for pick-up or tape heads.





NEW 17 & 25 WATT P.A. AMPLIFIERS

25 WATT $53.75
17 WATT $43.75
Post Extra on 15 Watt. N.S.W., 10/; Interstate, 15/.
25 Watt by Rail or Air. Too Heavy for Post.

The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves as microphone preamplifier and two EL34 valves Ferguson push-pull output.

All amplifiers are fitted with Ferguson output transformers with voice coil tappings of 2 to 15 ohms. The 25 watt amplifier can be supplied with line output transformers tapped from 100 to 600 ohms if required at $2.00 extra.

Inputs provided for microphones, pick-up, and radio with mixing facilties and tone control. The 15 watt is as above but using two 6BQ5 valves in push-pull output.

12in speaker for above (10 watt) **$6.75**
Crystal Microphones for amplifier **$4.75**

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

NEW TRANSISTOR SIX PORTABLE KIT AT LESS THAN HALF PRICE

(DESIGNED TO SELL AT OVER $6.00)

Excellent fidelity is obtained in this new kit set by the use of large speaker and polished timber case with attractive gold metal front panel. By using heavy duty batteries it is economical to operate and is ideal for portable use or that second set. Complete kit of parts is supplied with full instructions. CAN BE SUPPLIED WIRED AND TESTED AT $5.00 EXTRA.

$23.75 (£11/17/6)

Post and packing N.S.W., $1.25 — Interstate $1.75.

RESISTORS, CONDENSERS AND POTENTIOMETERS

We have purchased the resistor and condenser stock of manufacturers including S.T.C. and Stromberg-Carlson who have ceased the manufacture of television and radio receivers and can offer the same at less than 25 per cent of list price.

The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg. in ½, 1 and 2 watt ratings and include some wire wound resistors.

List price, $9.00 per 100. **Our price, $2.00 per 100.** Post and packing 25c extra.

The condensers are in most popular makes and include mica, ceramic, paper, and electrolytic in standard values.

List price, $11 per 100. **Our price, $2.06 per 100.** Post and packing, 35c extra.

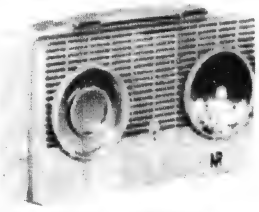
The potentiometers are all current types and include switch pots, dual concentric and T.A.B. pots.

List price, $12 per dozen. **Our price, $2.50 per dozen.** Post and packing, 25c extra.

FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Type Valve Type 6U7G, 6X5GT or 1T4.

SPECIAL — OFFER

Complete KIT for TRANSISTOR 6 PORTABLE $17.50



The complete kit of parts for the transistor six includes six transistors, printed circuit board, coil kit, 4in speaker, Ferguson driver and output transformers, heavy duty battery and all necessary parts to complete the set with full instructions. **Set is housed in attractive plastic case as illustrated.**

Dials available for all States. Post and Pack: extra. N.S.W., $1.00, Inter., $1.30.

NEW ENGLISH MAZDA TRANSISTORS

TYPE	EQUIVALENT		
XA101	OC45	R.F. Transistor	85c
XA102	OC44	Osc. Transistor	75c ea.
XB103	OC75	AUDIO general purpose	75c

Ducon type SFT 123 equiv. OC74 .. .. .. 75c ea.
Available in matched pairs at .. .. $1.50 pair
AUDIO OUTPUT
Post and packing on transistors 15c any quantity.

A.W.A. 23" E.H.T. transformers and 23" 110 deg. deflection yokes. New manufacturer's stock E.H.T. units $5.00. Deflection yokes $5.00. Post free

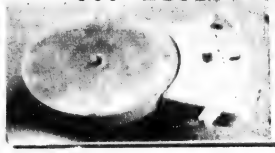
NEW VALVES AT BARGAIN PRICES

807	$1.75	3Q4	75c	6H6G	35c	6SJ7	95s
1A7GT	95c	3S4	$1.00	6K7G	45c	6SN7GT	95c
1C7G	30c	5V4G	$1.00	6K8G	68c	6SS7 equiv. 6SK7	85c
1D8GT	95c	6B8	$1.00	6Q7G equiv. 6D6G	$1.00	6U7G	45c
1K5G	40c	6C8G	80c	6SA7GT	95c	6X5GT	75c
1K7G	49c	VR99A equiv. 6J8G	$1.50	6SH7	85c	7C7	35c
1M5G	40c						
1P5G	25c						
1Q5G	25c						
1T4	45c						

12AT7	$1.00
1L5G	95c
12A6	80c
12SK7	80c
12SK8	80c
12SH7	80c
866	1.80
954	25c
955	25c
EK32	68c

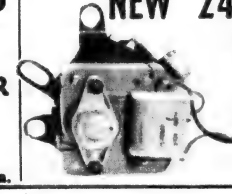
Please add postage on all valves.

NEW 4-SPEED STEREO & MONO PLAYERS AT LESS THAN HALF PRICE



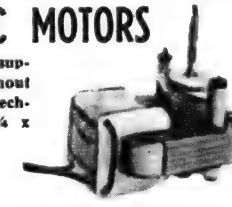
PHILIPS 4-SPEED
6V BATTERY PLAYER
MONO $9.75
STEREO $11.75
Post and Packing, N.S.W., 75c.
Post and Packing, Inter., $1.25 Extra.

NEW 240V. ELECTRIC MOTORS



3300 R.P.M. can be supplied with or without 4-speed reduction mechanism. Size 3¼" x 2¾ x 3½, including spindle.

$2.75



NEW PORTABLE RECORD PLAYER CASES TO SUIT THE ABOVE TURNTABLE

Attractive two-tone cabinet with plastic trim. Supplied with 5in x 7in speaker in felt-lined enclosure Space for amplifier and batteries or power supply.

$11.50 Dimensions: 15in x 13in x 7in. Post and Packing: N.S.W., 90c; Interstate, $1.20.

NEW MINIATURE MOTORS

Ideal for models, toys, etc. 1½ to 3 volts. 6,000 r.p.m. 39c each or $3.50 per doz. Post 10c.

EXTENSION SPEAKERS

$8.50 New 9 x 6 speakers in case. Post: Interstate, 55c; N.S.W. 40c.

NEW POWER TRANSFORMERS

60mA prim.: 240v with 230v tapping Sec. 285 x 285 with 6.3v filament winding. 60mA, $3.00. Plus Postage: N.S.W., 35c; Interstate, 52c.

Prim.: 240v, Sec. 385 x 385 at 80mA, fil. 6.3 and 5v, $4.50. Post.: N.S.W., 40c; Interstate, 75c.

60mA H.T. Chokes, 75c. Post.: 20c.

T.M.K. MULTIMETERS

Before buying see our range of T.M.K. test instruments. As advertised in April issue of Electronics Australia.

TYGAN AND SARLON SPEAKER GRILLE FABRIC

List price $8.00 per yard.
To clear at $5.50 per yard.
Postage and packing N.S.W., 35c. Interstate, 45c.

NEW MIDGET POWER TRANS.

40mA prim., 240v. Sec 225 x 225 with 6.3v. Fil. Winding.

$3.25 Postage: N.S.W., 25c; Interstate 45c.

30mA 240v Prim. 150 x 150v. Sec. with 6.3v Fil. Winding.

$3.25 Postage: N.S.W., 25c. Interstate 35c.

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools. spools.

2 Track, $35, 4 Track, $40.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

country to medium wave listeners and reception should be possible in New Zealand and Australia.

AUSTRALIA: A change in frequency has been made for the new 4KZ Innisfail — Tully station. The new frequency is 530KHz, instead of the previously assigned frequency of 800KHz. Station frequency change was made subsequent to conductivity tests. The station will use a directional aerial to limit radiation towards 2KM and 3UL, also on 530KHz.

INTERNATIONAL WATERS: Despite legislation now before the British Parliament making them illegal, off-shore radio stations continue to operate off the British coast. Radio Caroline South has transferred its headquarters from London to Amsterdam in the Nederlands. The move has taken place in great secrecy as the station could have to close its London office when the law against off-shore radio becomes effective. The station plans to continue broadcasts to the United Kingdom and is expected to begin programs in Dutch for the Nederlands. The address of Radio Caroline South is now Box 1390, Amsterdam, Holland.

NOTES from readers should be sent to ARTHUR CUSHEN, 212 Earn Street, Invercargill, N.Z. All times are Greenwich Mean Time, add 8 hours for Perth, 10 hours for Sydney and 12 hours for Wellington time. All frequencies in kilohertz (KHz) previously shown as kilocycles (KC).

The British Government's law against the offshore radio stations, the Marine Broadcasting Offences Bill may take some weeks before it has completed its passage through Parliament, but the appeal by pirate radio stations for their listeners to write to the British Prime Minister, appealing for private radio stations to continue, has resulted in over one million letters being received at 10 Downing Street, the Prime Minister's official residence.

ANDORRA: Radio Andorra on 719KHz plans to start an English commercial service, very shortly. Programs will be 0000-0500GMT. Radio Andorra is now using a new transmitter and aerial system with 19 towers. Programs are specially beamed for reception in the United Kingdom for early morning listening in Britain.

MALTA: Radio Malta, P.O. Box 384, Gwardamanga, is at present carrying tests on 1214KHz. Power is 1KW and the station is verifying reports. Listeners advise that signals are heard in Europe and North Africa. The station operates Monday-Friday 1300-1430, 1900-2200GMT and Saturday-Sunday 0900-16300, 1900-2200GMT. The station carries mostly popular music, and on Saturday and Sunday some programs are in both Maltese and English.

Malta is the site of the BBC Central Mediterranean relay base, and the BBC relay on 1178KHz has been heard in New Zealand at dawn. The station carries mainly BBC Arabic transmissions and is on the air 0345-0545, 1100-2100 GMT.

British Services station called BFBS Malta, on 1425KHz operates Monday-Friday, 0758-1308, 1628-2212GMT and Saturday-Sunday 0758-2215GMT.

HAWAII: Stations in Hawaii are giving good signals at the listening post of Mr B. Callaghan, Killara, N.S.W. Reception of KGMB, 590KHz, is reported to provide good all-year-round reception, although mixed with JOAK Tokyo at 1500GMT to after 1630GMT. KUMU Honolulu, a station which eoperates on a 24-hour-a-day schedule i sheard also, at 1600GMT. A newcomer at this location is KUAL on 720KHz, operating from Eleele. The signals from this source have been heard afte r1600GMT, but the frequency is one which suffers considerable interference from many Asian signals on the same channel.

ANSWERS TO CORRESPONDENTS

When writing to us:—

- *Please give your name and full postal address, including the State.*
- *Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.*

LOW FREQUENCY RUMBLE: My equipment cabinet carrying turntable and amplifier has been mounted on angle-iron which comes up clear of the floor from the foundations. Despite this, with the amplifier set for moderate volume and with bass boost, I can induce a form of low frequency feedback with the stylus resting on the stationary turntable. Would this be caused by a low frequency peak in my pickup cartridge or amplifier or by a resonance in the playing arm? **(A. McD., Flemington, Vic.).**

This kind of trouble is quite commonplace with single-unit cabinets and is one of the reasons why it is so difficult to obtain successful operation from a system, combining high power and a bass boost facility, in a single piece of furniture. With separate loudspeaker cabinets trouble occurs much less frequently, being then usually the result of a floor left springy by the subsidence of one or more piers. In your case, persistence of the trouble is most surprising. About the only way we could blame the room would be for a pronounced spatial resonance relating in part to the placement of the units. We doubt whether the pickup cartridge itself would have a resonance but it is possible that the cartridge/arm system, as a whole, may being producing a low-frequency peak. The amplifier could also be contributing a low-frequency peak, particularly if it is a valve type employing feedback around an output transformer. The loudspeakers should not be overlooked either. While we can speculate on these possibilities, we do not keep data of the performance characteristics of commercial equipment; it would be too big a task. One other observation we would make: given enough gain and enough bass boost, almost any audio system will approach a condition where low frequency regeneration is starting to be apparent. Most people are satisfied if the effect is not such as to prejudice or unduly colour the reproduction under normal playing conditions. You should certainly expect to have achieved this much by the means you have adopted. If you haven't, there must be a peak or a collection of peaks somewhere in the system.

SHORT WAVE RECEIVER: You mentioned in a recent issue that you might publish a series of short-wave sets. I would like to see this done and hope that you come up with something a little more modern than, and not so complicated as, the communication sets requiring special coil boxes published a year or two ago. **(R.M.J., Adelaide.).**

As you will have seen, we have already published the first of the promised designs. We hope that this is what you wanted and that it is not too complicated for you.

SW ON CRYSTAL SET. I am a beginner in electronics and have built myself a crystal set. Recently I heard the Pacific Service of Radio Australia on 11.7MHz from 7 o'clock until 9 o'clock after which time performance fell off. Could you please explain this phenomenon? **(A.S., Oamaru, N.Z.)**

Normally a crystal set will not receive short-wave signals, for two reasons. Such sets are designed to tune over the broadcast band only, plus the fact that short-wave signals are normally too weak to be resolved by such a simple set, even if it were capable of tuning to the required frequency. Occasionally, however, freak conditions result in a very strong short-wave signal appearing in certain areas, and these are strong enough to force their way through the set, in spite of the favourable tuning. We have heard of odd cases like this before, but we still regard them as the exception rather than anything else.

USE YOUR POSTCODE

When writing, please make sure your address is complete, including the POSTCODE. Addition of the latter will ensure minimum delay in handling your letter. Also make sure that your address is legibly written or, for preference, PRINTED. A significent number of letters are returned to us each month because the original address was incomplete or illegible.

"A YOUNGER READER." As a former schoolteacher I would commend the writer of the letter published in "Forum" (Electronics Australia, July, 1967) for his command of English. I also envy him his home situation with a father who is prepared to give him guidance and understanding; I did not have this good fortune in my childhood. Regarding valve type numbers, I always paint the type numbers on the chassis of my own equipment so that valves can be identified and replaced any time. I enjoy reading your magazine and wish it continued success. **(M.G., Port Melbourne, Vic.).**

We agree with both your observations about this young correspondent. It's all too easy, in these busy days, for parents to be so preoccupied that children are left to their own devices. Curiosity about technical things may wane and give place to less constructive activities.

PROSPECTIVE READER: Radio Canada Shortwave Club recently carried a request for books which might interest one of their members. Since "Electronics Australia" should fill the bill, you may care to get in touch with him. **(I.R., Heidelberg, Vic.)**

Thank you for thinking of us. We have sent him a complimentary copy, as per your suggestion. He may care to take out a subscription and, if he has any friends who are similarly inclined, that would be all to the good!

AERIAL PERFORMANCE. I constructed one of your TV aerials some time ago and it performed perfectly on Channels 2, 7 and 9. I have since had Channel 0 added to my set and find now that the performance is not so good. I have been told by a serviceman that I need a different aerial, and apparently others in Melbourne are having the same trouble. I live in a good viewing area, and the aerial is under a tiled roof. **(G.S., Preston, Vic.)**

Assuming that it was properly fitted and the necessary adjustments made to the tuner, the addition of the Channel 0 coils should not have affected the performance of the set on other channels. However, it is likely that results will be poor on Channel 0 unless an aerial cut for this channel is employed. We have no details of a combined aerial for these channels, but details of individual aerials for each of the 13 channels are available through the postal query service. In fact, commercial aerials are now so readily available and so relatively inexpensive for the ordinary urban types that the incentive to build rather than buy is small.

"ELECTRONICS Australia" Information Service

As a service to readers "ELECTRONICS Australia" is able to offer: (1) Photographs, dye-line prints and other filed material to do with constructional projects and (2) A strictly limited degree of personalised assistance by mail or by reply through the columns of the magazine. Details are set out below:

REPRINTS: For a 20c fee, we will supply circuit data, as available from our files. The amount of data available varies but in no case does it include material additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuit data will be answered more speedily if the circuits are positively identified and the request is not complicated by questions requiring the attention of technical personnel. Where articles are not on file, we can usually provide a photostat copy at 20c PER PAGE.

PHOTOGRAPHS, DYE-LINE PRINTS: Original photographs are available for most of our projects, from 50c plus 8c postage for a 6in x 8in glossy print. In addition, metalwork dye-line prints are available for most projects for 50c each; these show dimensions and the positions of holes and cut-outs but give no details of wiring.

BACK NUMBERS: A fairly good selection is available. On issues up to 6 months old there is a surcharge of 5c. On issues from seven to 12 months old the surcharge is 10c. Over 12 months, it is 20c. Package and postage is 10c extra in all cases.

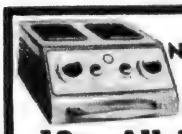
REPLIES BY POST: This provision is made primarily to assist readers in matters relating directly to articles and projects published in "ELECTRONICS Australia" within the last 12 months. Note, however, that we cannot provide lengthy answers, undertake special research or modifications to basic designs. A 20c query fee must be enclosed with letters to which a postal reply is required; the inclusion of an extra fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries which fall outside the scope of "Replies by Post" may be submitted without fee and may be answered through the columns of the magazine at the discretion of the Editor. Technical queries will not be answered by telephone.

COMMERCIAL EQUIPMENT: "ELECTRONICS Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals receivers, amplifiers, etc. We are therefore not in a position to comment on proposed adaptation of such equipment, or on its general design. "ELECTRONICS Australia" does not deal in electronic components. Prices, specifications or other assistance must be sought from the appropriate advertiser or agent.

REMITTANCES: These must be in a form negotiable in Australia. Where the charge may be in doubt, an open cheque, endorsed with a limitation, is recommended.

ADDRESS: All requests for data and information, as set out above, should be directed to The Assistant Editor, "ELECTRONICS Australia," Box 2728 G.P.O., Sydney, N.S.W., 2001. Other correspondence should be directed to The Editor. 9/67



NEW IMPROVED 30 WATT

12v. All Transistor P.A. AMPLIFIER

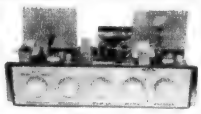
No. 398—Complete Kit of parts to smallest screw. $57. No. 656 — Wired ready to operate, $60. Freight extra. Size: 6in w. x 3in h. x 8¾in d. Weight 6½lb.

MAGNETIC STEREO PRE-AMP

In 5Mv. out 500Mv. Bass and treble 18 D.B. No. 700C, $29. Wired ready for use, $31. Postage 30c.

COILS & IF's 455 Kc

Aer, R.F. osc. and IF's . . $1.70 ea.
Ferrite Aer . . . . . $2.
No. 265 Universal Tape OSC coil, $6.
Postage 10c. Write for details and price



STEREO

MULLARD 12 TRANSISTOR

5 watt x 5 watt.
Distortion ½ of 1%. Frequency response 30 cycles to 18Kc. Output 15 ohm speaker.
12in lg. x 7in d x 4in h.

Pre-Amplifier kit No. 616C	$26.00
2—5w Main Amplifiers No. 675C	$34.00
1—5w Power supply No. 681C	$16.00
Steel chassis, plated No. 649	$ 2.50
COMPLETE KITS, nuts, screws, etc. No. 471C	$78.50

Wired and tested, No. 471D, extra $5.00. Freight extra. Write for blueprint list of parts.

R.C.S. PRINTED CIRCUITS

For all R. & H., E.A., Mullard, Philips and other designs. Clearly coded. White letters and numbers, easy assembly and service, polished and resined for easy soldering. With blueprint parts list.
SPECIALS: To your drawing under 6in x 6in. $4.

New Printed Circuits

700 Magnetic pre-amp $3
703 Mull. 7W. stereo. $3
704 Pre-amp 67.P2 $2.50
707 10W stereo, 67. P3 $2.50
708 10W. amp. 67. A3 $2.50
709 Pre-amp 67.P3 $2.50

Recent Designs

Part No.
675 HI-FI 5W. amp. $2.50
684 Pre-amp. 65.P10. $2.50
685 Pre-amp. 65-P12A $2.50
686 Pre-amp 65.P12B $2.50
690 Philips 10W. amp $2.50
693 Electronic Flash, $2.50

Write for full list. Immediate despatch. Postage 10c.

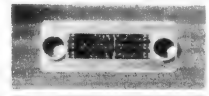
Postage $1.

R.C.S. COMPLETE DO-IT-YOURSELF KITS

Peak reception, low price. No expensive test equipment. Everything fits. 1964 RF Transporta 7. Complete kit—No. 640 . . . . . $43.50
Portable car radio, identical to 640 above, plus extra switch and car coil, etc. No. 642 . . . . . $46.00
(Write for booklet on 640 and 642.)

HI-FI BROADCAST TUNER UNIT 4 TRANSISTORS—HI SENSITIVITY

R.F., mixer, I.F., pwr. dectr. stages, adjustable aerial coupling. Complete as illust., wired and tested with 461 dial, knobs and switch pot, No. 474, $31. Complete kit of parts for above, No. 474C. $30, postage 40c.



WHISTLE FILTER for above, No. 128. $4 Post. 10c.

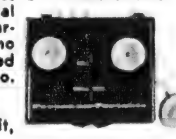
IMPROVED BATTERY SAVER KIT

4½, 6 or 9 volts. Replaces transistor battery power input 240 volts A.C. Maximum milliamps 100. Hum-free operation. Size 3½in l. x 2½in w. x 1¼in h. No. 657, $6.50 (post 10c).

PERSONAL PORTABLES

Range 30 miles, 200 with short aerial and earth. Earpiece only, no speaker. Wired ready to use, No. 666D, $10.
Postage 20c.
Do-it-yourself kit, No. 666C, $9.00.

2 TRANSISTORS



1 TRANSISTOR—1 DIODE

582 Do-it-yourself kit . . $5, post. 10c.
593 Wired ready to operate, $6, post. 10c.

DIAL KITS

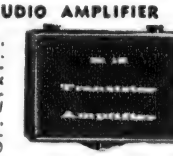
Scale gold with white letters. Size 6¾in. x 2¾in. to match.

- No.459 300pf gang, $4.00
- No.461 200pf gang, $4.00

Post 20c.

NEW AUDIO AMPLIFIER

4 transistors. ½ or 1 watt. Small size: cabinet 3" x 2" x 1" plastic. Suitable crystal P./up. Intercom., microphone radio, etc. (9 volt)



Do-it-yourself kit 665, $10 (Post 10c).
Wired ready for use, 665D; $11.50.

NEW TRANSISTOR PREAMP KITS:

SIZE 3 x 2 x 1in 2 req. for Stereo.

LOW IMP. input 2 trans. 672C	$6.50
Wired ready for use, 672D	$8
HIGH IMP. silicon 2 tran. 680C	$6.50
Wired ready for use. 680D	$8
HIGH IMP. silicon 3 tran. 682C . .	$8
Wired ready for use. 682D	$9.50

Postage 10c each. Write for data.

R.C.S. *Order by Mail Order, Postal Note or Money Order (add post.), direct to—*
RADIO PTY. LTD., 651 FOREST ROAD, BEXLEY, N.S.W., 58-3491, 58-5385

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The famous German LOTRING range of fine soldering tools now made in Australia. Highly finished handle assembly fits any one of 4 high efficiency elements making a lightweight precision tool. Purchase one basic soldering tool and by adding extra elements expand the irons capabilities. Available in 32V. 25W. 50W. 80W. and 240V. 25W. 50W. 80W. & 120W. Choice of bits and attachments.

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888 Hay Street

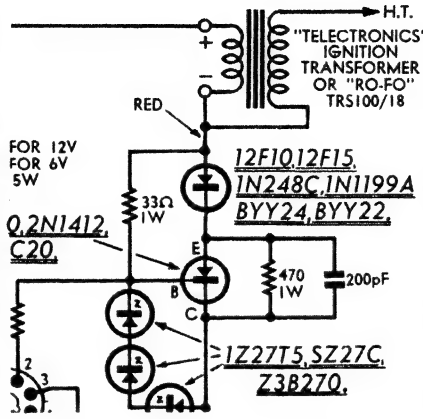
BAROMETRIC SWITCH: I am working on a barometric switch to be used to eject a parachute from a model rocket. The mechanism of the switch is as follows: A moveable arm will be connected to a pair of bellows, of the type used in barometers. As the air pressure decreases with increase in altitude the arm will move across a number of contacts. As I do not know the exact altitude to which the rocket will rise the number of contacts over which the arm is free to pass will be greater than required. My problem is to find some way to prevent the parachute from being ejected when the arm passes over the contacts for the first time, i.e., when the rocket is rising. The parachute is to be ejected when the arm passes over the contacts for the second time, i.e., on its way back when the rocket is falling. This means that, having attained maximum altitude the parachute must be ejected when the arm passes over the very first contact on the way back. I have included a diagram with explanations of what is needed. **(S. J., Footscray, Vic.)**

This is a classic example of the kind of letter which tends to gum up our query service. We ask S.J.— and other readers— to consider just how long it would take to produce a practical solution to this problem. It is in fact, more like a project for publication which must be counted in days and weeks rather than hours. Even the time taken to read a letter like this— it was a good deal longer than the above condensation might suggest—is time we can ill afford when there are other letters, with more admissible problems, waiting to be answered. So please, before you write that letter, study the panel on these pages to make sure your problem comes within the scope of the service.

HIFI ENTHUSIAST: I have been a hifi expert ever since plugging an Acos GP-20 into a 30/ junk radio. Since then I have used a variety of magnetic cartridges, but am now well satisfied with one which sells in Australia for $120 but which I imported from the U.S.A., duty and all for $65. It has excellent "trackability" and has turned some of my "distorted" records (e.g. Col. SAX02318, Beethoven's No. 8, by Klemperer) into shining examples of clarity. I wonder how many such records have been condemned by "experts" like myself who only thought they were using the best equipment! I am also equipped to play prerecorded tapes but, after two years of living with the gear, I find the tapes played little compared with the discs. They're awkward to handle and the signal/noise ratio isn't so hot either. **(J.C., Dilston, Tas.)**

Our general impression is that modern magnetic cartridges are fairly uniform in their frequency response but that they vary a good deal in their ability to track heavily recorded passages. In itself, this is not a simple function because the trackability of cartridges varies with the frequency involved and a single test track may happen to favour the characteristcs of one more than another. At the same time, we feel that the wise recording engineer will match his amplitudes to what current (and average) good quality pickups will track rather than to the outstanding best, which may be operated by only a very small percentage of customers. Where we sense, in our reviews, that amplitudes may embarrass a proportion of pickups, we usually make cautious reference to the fact. Your reaction to the signal/noise ratio is exactly in line with our own and is the basic reason why manufacturers are doing their level best to overcome the problem. (See "Audio Topics," August, 1967). At the same time, there are those who profess to be less worried by tape hiss than surface pops of records. This is a generality which involves the person's ability to hear hiss, or their equipment's ability to reproduce it, as well as the care — or lack of it — with which they treat records.

TRANSISTOR IGNITION: I have assembled the transistor ignition unit for negative chassis vehicles as described in R, TV and H, June 1964. When I purchased the Rofo TRS100/18 transformer I found that the low and high tension



windings are internally connected, indicating that this coil cannot be connected into the De-Luxe unit as shown. **(R. J. Bondi, N.S.W.)**

The Rofo TRS100/18 is quite suitable for use with this circuit R. J., although we admit that the circuit may tend to be misleading. It is not necessary for the HT secondary to be connected directly to chassis. Where the coil is internally connected as in the Rofo, the secondary chassis connection is simply ignored, the HT circuit being completed through the primary circuit. (See diagram.) Incidentally, the Jaguar car on which this original circuit was road tested, using the Rofo coil, was used for everyday driving for over two years, without failure of any kind. It was then sold, and the last we heard of it it had completed a round-Australia tour, again without any problem from the transistor ignition system.

"CURRENT" FLOW: I have a problem concerning the working of a valve. I understand that the electrons flow from the cathode to the anode, and I also understand how the grid controls the flow of electrons (or current). On page 51, Chapter 10, of the Basic Radio Course, it reads, "This ever changing current flowing from the High Tension or B-battery through the phones, in sympathy with the grid signal . . ." Now, which way does the current flow? Also, in the circuit (submitted) on which side (of the resistor) is the voltage drop? **(I. C., Capalaba, Q.)**

It may be some consolation to realise that your problem is quite a common one; almost every student who has studied valve behaviour in detail has asked the same question. The problem is almost entirely one of convention and terminology. We have dealt with the problem many times before in the magazine and we also dealt with it in the very first chapter of the Basic Radio Course (page 7). We quote: "Unfortunately . . . we run up against an apparent contradiction. The early pioneers knew nothing of electrons, although they could observe the effects of electric current and potential. So charges were labelled 'positive' and 'negative' for identification, after which they reasoned that current must flow from positive to negative. Unfortunately they were wrong and we can do no better than brand their ruling as the 'conventional' direction of flow. But, for our own clarity of thought, let us remember that true electric current is a movement of electrons and is always from negative to positive." Your question, ". . . on which side is the voltage drop?" indicates a lack of appreciation of voltage and current behaviour. Voltage drop does not occur on "one side" of a resistor, it occurs between the two ends of the resistor. Voltage cannot exist at an isolated point, but only between two points.

WANT PARTS: I belong to a group in need of radio parts. Would there be any hobbyists who no longer require parts, who would donate them to us? **(S.M., Moorooka, Qld.)** I am a student and interested in electronics as a hobby. I would be interested in gear like that mentioned in "Forum." **(B.P., Wollongong, N.S.W.)**

It is hard to refuse publication of a request like yours but, as we have explained on previous occasions, it would be quite impractical to open our columns for free publication of requests for parts, penfriends, give-away offers and such like. On the other hand, for 60c per line you can put in a regular classified advertisement to which you may get any number of replies. This will cover our costs and, from your point of view, could be a good investment. Incidentally, S.M., we could only guess at your initials; your signature is not easy to decipher. When writing to a magazine, it is a good idea to print your name and address in block letters under your normal signature.

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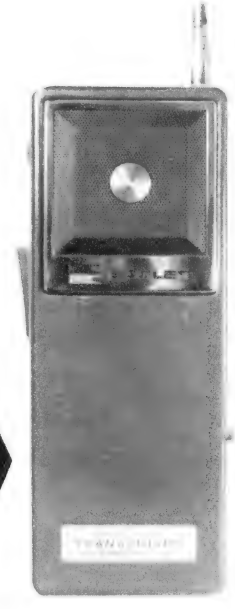

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ANSWERS TO CORRESPONDENTS—Cont.

SUGGESTIONS FOR ARTICLES: Your magazine is a first-class production and is certainly far ahead of similar imported periodicals. I wish you every success in keeping it so. I would like to suggest articles on "The Diode Marking Muddle" and the Philips cassette tape recorder. Also why not try to standardise your transistor circuits on 12 volts which would make them immediately suitable for use in caravans and with automotive supplies? **(D.H., Sale, Vic.).**

Thanks for the bouquets. We will have a look at your suggestion regarding diodes and their markings. While the Philips cassette unit has earned a lot more attention in Australia since the article on cassette systems appeared in "Audio Topics," the race for market preeminence has really not yet begun. You can rest assured that we will have more to say on the subject, perhaps with a constructional emphasis, when the time seems ripe. All recent battery chargers have had provision for 12-volt systems and you need have no worries on this score. Whether transistor equipment could logically be standardised on a 12-volt supply is another matter altogether. A large order of precedence has been built up for 9 volts for equipment intended for operation from dry batteries. Again, voltages of 20 or more may well be a technical necessity for mains operated amplifiers required to give higher orders of power output. It may impose a quite unreal restriction on designs to tie them too tightly to your concept of suiting everything, as a matter of course, to use in a caravan.

HERTZ. I do not like the term Hertz. If other countries use the term, it does not follow that we have to do the same. **(E.B., Murrayville, Vic.).**

It's not just a question of the term Hertz being used in magazines; it is being adopted as standard by major institutions throughout the world. Again, in casual conversation and casual articles one may choose to understand the "per second" part of the old term but such practice is hardly appropriate in a formal context. Finally, with the free exchange of information which characterises this modern world, there is good reason to conform to common practices and this involves both give and take.

STEREO/MONO RECORDS. I must admit to being confused by the reasoning presented in the June, '67 issue regarding compatability of stereo/mono pickups. The article states that heavy bass is steered toward the centre, the idea being that this part of the signal will exhibit mono characteristics. The implication is that signals recorded as mono on a stereo record will be traced laterally as in a mono record. However, I have understood that, in the 45/45 method of stereo recording, signals presented to the cutting stylus in equal intensity and phase will be manifest as a vertical component, the very thing we are trying to avoid. In any case, if a mono pickup cannot resolve the vertical component of the stereo information, but can fully resolve the "mono" signal, would not this produce an imbalance in the overall response? **(E.C., Rosanna, Vic.).**

A helpful discussion of this whole matter appears in "From Microphone To Ear" by G. Slot, one of the Philips Technical Library series of publications. Slot points out that, very early in the history of 45/45 recording, the industry had to make up its mind how to phase the two coils in a cutter, since common signals could produce either a vertical or a horizontal resultant. He points out that industry deliberately chose what they called "in-phase" operation, designed to produce a horizontal resultant from a common signal reaching both channels simultaneously. Purpose of this was to make the resulting stereo

(Continued on page 174)

THE CHRISTIAN BROADCASTING ASSOCIATION

(Continued from page 17)

talk-back and monitoring speakers are all mounted in a common enclosure. Studio signal lights "(Stand By," "Commence," "On Air") and door warning lights ("Caution" and "On Air") are also controlled automatically from the mixing consoles, using relays mounted in the booth racks.

CBA was the first broadcasting organisation in Australia to use continuous tape cassette machines. The organisation purchased two prototype machines manufactured by the American Schafer Company after they were exhibited by AWA in Sydney. The original paint-spot machines have been modified to cause the tape to stop on a 13,000Hz tone which is filtered from the audio signal on the tape. All program credits (i.e. announcements at beginnings and endings of programs) are pre-recorded on these cassettes, then played into the console mixer.

All preamplifiers and program amplifiers are rack-mounted identical and interchangeable EMI type 806 amplifiers. Used as preamplifiers, they accept the low level signals from microphones and pickups, and raise the signals to a common level of —15dBm. These signals are then presented to the faders on the mixing console. During the mixing process the level drops to —40dBm, after which it is presented to the rack-mounted program amplifier which raises it to —15dBm and presents it to a splitting amplifier whose eight 600-ohm outputs are in turn fed to tape recorders, monitor power amplifiers, and to equipment in other parts of the building.

Limiting amplifiers, electronic echo devices and frequency equalising networds are switched in, as required, between the console faders and the program amplifier, or at any other desired point in the console. Comprehensive patching facilities enable the operator to readily line up any desired combination of functions and facilities.

Daily preventive maintenance is carried out by CBA's team of engineers, who use an AWA Beat Frequency Oscillator, an AWA Noise and Distortion meter, and response curves plotted on carefully indexed cards, one card for each piece of equipment. Maintenance includes testing, cleaning and lubricating of all machines, faders and switches. All equipment conforms to Australian Broadcasting Control Board Standards.

Standard equipment in each control booth is an EMI tone generator which delivers a signal of 800Hz. This tone is fed into the mixing console at the touch of a button, and is used to test and align audio circuits, including VU meters and tape recording levels.

CBA tape recording is carried out to professional standards, using full-track, 15ips or 7½ips, and the standard CCIR recording curve. The American NAB curve is also available through a switch.

The CBA installation is designed to bring all audio signals out to patchboards and faders on balanced 600-ohm lines, all of which are carefully shielded and earthed to avoid cross-talk and to prevent induction from unwanted sources. It is a tribute to the CBA engineers that, although CBA is only a few miles from four 2,000 watt commercial transmitters, no RF signals are picked up in the CBA installation.

The installation is "fail safe" in the sense that should any fault develop in any piece of equipment, it can almost instantly be bypassed or exchanged without interrupting production.

CBA uses a wide variety of microphones, including the well-known RCA 44BX ribbons, STC "billiard balls," STC pencils (all moving coil), STC cardiod (a combination ribbon and moving coil), the 16-pattern AKG condenser, and the AKG moving coil. Each microphone has its own application in relation to people and studios.

Visitors from all States and from overseas are always welcome at CBA, and will be shown over by Chief Engineer Andrew Gates, studio supervisor Eric Bird, or director Rev. Vernon Turner. ■

record compatible in the sense that a single, central source would produce a lateral track, which could be traced normally by a mono pickup. He goes on to point out, however, that true compatibility was limited by the amount of compliance which the mono pickup displayed in the vertical direction. He explains that some companies had adopted the idea of centring heavy bass in relation to the microphones so as to limit travel in the vertical direction for components which were not particularly directional. Since this book was published in 1959 and the latter reference appears as nothing new, the basic technique behind "modern" compatible stereo/mono discs is just about as old as stereo itself. Slot's 1959 comment could as easily have been written last month: "Some of the record manufacturers who use this technique state that their stereo records may be played with monophonic pickups but we like to repeat our warning . . . etc." As regards the possibility of frequency imbalance when playing a stereo record with a mono pickup, we agree that this is possible though, in practice, switching to mono mode does not appear to upset response to any extent.

REVERBERATION UNIT. Most commercial amplifiers incorporate tremolo and reverberation facilities. You recently published two amplifier circuits incorporating only tremolo. Have you any plans for a reverberation unit to be used with these amplifiers? **(B.T., Perth, W.A.)**

We have developed a reverberation system for use with our recent guitar amplifiers and plan to publish the design.

ANSWERS TO CORRESPONDENTS. I read this page first because there are usually quite a lot of interesting hints in it. I agree with A.S. of Wollongong in the August issue but, at the same time, I think that "Electronics Australia" is a reasonable compromise in that you publish a mixture of simpler and more advanced articles. Why is it that only about 25 p.c. is dedicated to short-wave, C.B. and broadcasting, while it makes up about 80 p.c. of "Radio-TV Experimenter." **(G.K., Pennant Hills, N.S.W.)**

First off, we devote little or no space to "C.B." or anything like it in "Electronics Australia." What you take to be C.B. pages are actually notes on the activities of licensed amateur radio stations. In the U.S., Citizen Band equipment and activity is of an order which currently supports a number of magazines but it also has the Federal Communications Commission very worried —so much so that they are talking of placing very strict restrictions on the use of C.B. equipment. The Australian authorities are apparently determined to do their best to see that similar equipment does not get out of hand in this country. As far as the proportion of space devoted to individual subjects in individual magazines, it is a matter for editorial policy based on what appears to add up to the most saleable journal in the particular market. "Electronics Australia" is selling very well at the moment in Australia, indicating that our space allocation can't be too far from the mark! ■

READER BUILT IT

(Cont. from page 103)

tion also makes linearity independent of component tolerances but necessitates recalibration and readjustment of the horizontal circuit.

While some form of bootstrapping is an accepted way of achieving linearity in sawtooth circuits, most of these are too complex to be considered as suitable for inclusion in the design of a compact instrument such as the "1966 CRO." The object of this modification was to find a simple solution worthy of this fine little instrument and I think I have achieved this with the modification I have suggested. (F. Thomas, Newcastle West, N.S.W.). ■

CLASSIFIED ADVERTISING

Advertisements in these columns cost $0.60 per line. Each line contains the equivalent of five words each of nine letters. Minimum size of advertisements is two lines. Please note PAYMENT MUST ACCOMPANY ALL ADVERTISEMENTS EXCEPT THOSE PLACED BY ACCREDITED AGENCIES. Your advertisement for the October issue must reach our office before September 6th. Address your advertisement to the Advertising Manager, ELECTRONICS Australia, Box 2728, G.P.O., Sydney.

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TRANSCEIVERS 27MHz, xtal cont. tx-rx. Range 1 to 3m. Int. spkr., ear phone, and hide case. New $100 pair. 27MHz xtals avail., prs. with 455KHz spacing, $4, each or $6 pair. S.C.R. CRS 1/10 AF 100V 1A $5. Apply 6/105 Annie St., Toorwood, Qld. 4056.

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WANTED: Disc cutter, good condition. Write J. Prucha, 21 Palm Ave., Surfers Paradise, Qld.

WANTED: All surplus radio and TV parts, valves, etc. CASH. Last, 847 New Canterbury Rd, Hurlstone Park, N.S.W. 55-7151.

SPOKEN word recordings in good condition. Drama, poetry, prose. Details and price. B. G. Croft, P.O. Box 2087, Konedobu, Port Moresby, Papua.

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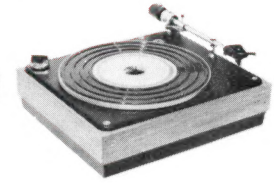

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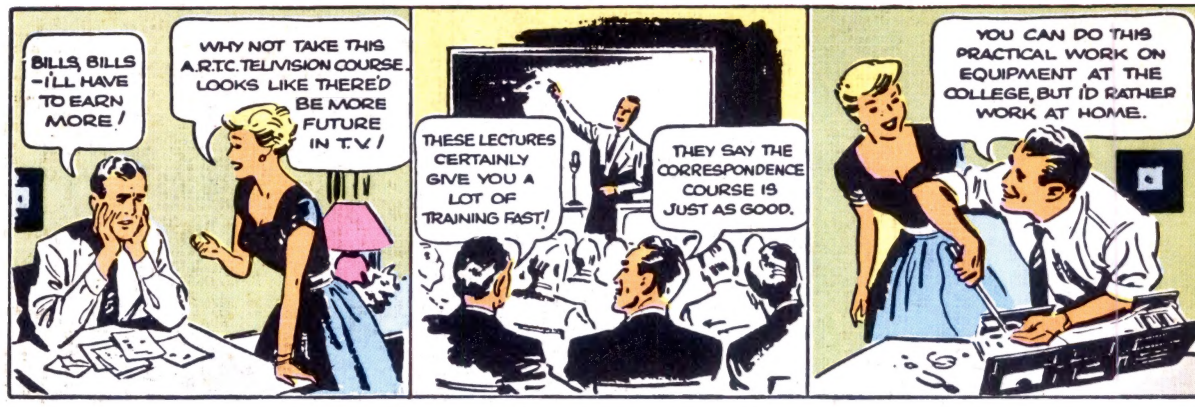

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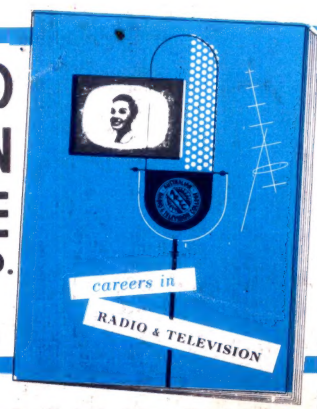

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